Psychological antecedents and outcomes of leisure time physical activity for mainland Chinese international students in Canada

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

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Abstract

The purpose of this research was to examine the physical activity of mainland Chinese international students in Canada. Particularly, the relationships between physical activity, social cognitive variables (i.e., self-efficacy, social support, intention, access), mental health (i.e., stress, subjective well-being, acculturative stress), and culture variables (i.e., self-construal, acculturation) were compared at different stages of undergraduate study. In the first study, data were collected with Chinese undergraduate students ($N = 323$) to examine the reliability and validity of the survey instruments translated into simplified Chinese. Factor structures were identified for each questionnaire, and some were modified for use in studies two and three. The test-retest ($N = 21$) yielded mixed results, with intraclass correlation coefficients (ICC) ranging from poor to good for most scales. State or context in which the participant completed the measures may be an important consideration.

Two models were examined using the data from Chinese undergraduate students ($N = 317$; 54.8% female). In the first model the structure of social cognitive theory in relation to moderate and vigorous physical activity was tested. Social support was related to higher vigorous physical activity and self-efficacy ($\beta = .29$). Self-efficacy was related to greater intentions to be physically active ($\beta = .67$) and perceptions of access to places to do physical activity ($\beta = .52$). Social support is an important facilitator of physical activity for Chinese students, and may be especially important for those who endorse an independent self-construal.

In the second model, relationships between vigorous and moderate intensity physical activity and mental health (i.e., stress and subjective well-being) were examined. Moderate physical activity was significantly negatively related to stress ($\beta = -.18$; $p < .05$), and also shared a relationship with subjective well-being ($\beta = .11$; $p < .10$). Vigorous physical activity was

related to stress (β = -.10; $p < .10$). Physical activity may be used to mitigate stress and improve subjective well-being in Chinese students.

In study two differences in the social cognitive, mental health, physical activity, and culture variables at the beginning and end of Chinese international students' first year of study were examined. Students completed online surveys in their first months in Canada (T1; September 18 – November 23, 2017; $N = 54$), and three to six months after they began their academic term (T2; February 27 – April 15, 2018; $N = 22$, 59% female). General stress increased from T1 to T2 ($p = .004$). Bivariate correlations showed social support, self-efficacy and intentions may be related to physical activity. Social isolation, academic pressure, language insufficiency, family guilt, stress, exercise as a coping mechanism, subjective well-being, and discrimination were correlated across time points. Physical activity and self-efficacy were not stable over time. The increase in stress may support the hypotheses that mental health may decline over time as initial excitement about a new experience wanes. Addressing language and social isolation issues could also help improve international student experiences in Canada.

In study three, physical activity, social cognitive variables, mental health, and culture were compared between first year ($n = 92$), second year ($n = 52$), and senior (3^{rd}-5^{th} year; $n = 77$) Chinese international students. Senior students perceived fewer places to do physical activity, and more discrimination compared to first and second year students. Second year students rated themselves lower on academic pressure and family guilt compared to senior students. First year students had more general stress compared to the second year students. In the regression analyses, self-efficacy, intention, and exercise to reduce stress shared relationships with vigorous intensity physical activity. Subjective well-being was positively related to moderate intensity physical activity, and self-efficacy and independent self-construal were related to walking. First

year students walked more than senior students. Chinese international students may perceive their environment differently, and experience different kinds of stress as they advance in their academic years.

Together, this research demonstrates the importance of cultural contextual factors in physical activity behaviour for Chinese students studying abroad and in their home country. Chinese students may benefit from improving self-efficacy and planning for physical activity. First year international students may need more support for stress reduction. Language and social integration programming may help encourage physical activity and promote positive experiences for Chinese international students in Canada.

Preface

This thesis is an original work by Kimberley D. Curtin. The measures described as one section in the document are described separately in the manuscripts submitted or in preparation for submission to peer-reviewed journals.

Study one received ethics approval from the University of Alberta Research Ethics Board (Pro00069892). Part II is currently in preparation for submission to *Measurement in Physical Education and Exercise Science*. The data from this study is published in the University of Alberta Database (Curtin, 2018).

Study two received ethics approval from the University of Alberta Research Ethics Board (Pro00074810), and the Calgary Health Research Ethics Board (REB17-1431). Data collection will terminate in March 2019.

Study three received ethics approval from the University of Alberta Research Ethics Board (Pro00070709), and the Calgary Health Research Ethics Board (REB17-1406).

Acknowledgements

It is impossible to imagine my doctoral journey without the superb guidance provided by Dr. Tanya Berry. Under your supervision I felt autonomous yet fully supported in my learning. I am grateful that you have shared your insights and knowledge with me over the years. You have shaped me in to a competent and eager researcher.

I owe many thanks to my committee and examiners Dr. Gordon Walker, Dr. Wendy Rodgers, Dr. Kim Noels, Dr. Harry Prapavessis, and Dr. Janice Causgrove Dunn. Thank you for your time, generosity, curiosity, and genuine examples of academic service. Thank you for making me better. Thank you to Dr. Huimei Lui, who kindly hosted me at Zhejiang University and offered advice and support during my time in China.

My graduate student career has been marked by some of the most wonderful colleagues and friends I have had the pleasure of interacting with regularly. Your smiles in the hallway and high fives on the intramural field made my time here brighter. I am so grateful to Jinging, Nanxi, and Chen for translating my surveys and information letters into Chinese and for your insights into Chinese culture. I literally could not have done this without you. To Lira, Kim M (a.k.a. karate Kim), Annie, Elaine, Jodie, Kelsey, Sarah, Megan, Izabela, and of course Maxine; we've been through too much for a few lines in this document. I am so honoured to have met you all.

To my mom, dad, Kate and Beth: You never doubted me for a minute when I suggested pursuing another graduate degree and you have never wavered. You are my constant source of encouragement. Andrew, you have sacrificed so much for me to pursue my goals. You are truly my best teammate in life. I cannot wait to marry you.

I would like to acknowledge the Social Science and Humanities Research Council for funding this project (file number 767-2014-2671).

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Chapter 1: Introduction

1.1. Literature Review

Many people come to Canada to pursue post-secondary or graduate education as international students. In 2010, there were over 218,200 international students in Canada staying for at least six months (Roslyn Kunin & Associates, 2012). About 20% of the University of Alberta population is composed of international students (University of Alberta Data Warehouse, 2017). Students at the University of Alberta represent 147 countries, including many Asian countries. Chinese comprise the largest international student group with 3,072 undergraduate students enrolled in the 2016-2017 academic year, representing over 60% of the University of Alberta's international student population (University of Alberta Data Warehouse, 2017). Furthermore, in 2014, Chinese students represented over 32% of the total international student population in Canada (Canadian Bureau for International Education, 2016). International students often reported that adjusting to a new country can be stressful due to language issues, adaptation to a new culture, and financial problems (Sherry, Thomas, & Chui, 2010; Smith & Khawaja, 2011). Addressing these issues can lead to a more productive and positive experience in Canada for international students.

A potential way to improve adaptation processes for international students is through physical activity. For students across the world, physical activity was positively related to life satisfaction (Grant, Wardle, & Steptoe, 2009). In Chinese adolescents, vigorous physical activity was a protective factor against depressive symptoms, and school life dissatisfaction (Cao et al., 2011). The purpose of the present dissertation research was to examine how leisure time physical activity is related to mental health outcomes for mainland Chinese international students and to determine how social cognitive and cultural factors are related to leisure time physical activity

behaviour over the study period of undergraduate students. These objectives were addressed using three studies.

The first study was conducted in China with undergraduate students from mainland China. The primary aim of this study was to examine the reliability, content validity, and factorial validity of the survey instruments translated into simplified Chinese. Several changes were made to the survey items based on exploratory factor analyses. Secondly, two models examining the social cognitive predictors and mental health outcomes of moderate and vigorous intensity physical activity were generated. From these models, insight was gained into the importance of social support for vigorous physical activity, and relationships between moderate physical activity and stress reduction for this population. These studies provided a foundation which informed the next two studies. Studies two and three were conducted in Canada with mainland Chinese (China/Chinese hereafter) international students. The purpose of these two studies was to understand the impact of time on the cultural, social cognitive, mental health, and physical activity variables of interest. In study two, first year students were examined at the beginning (3-6 months) and end of the academic year to examine possible changes over this time period. First year students were then compared to a second year and senior (third to fifth year) Chinese international students in study three. These studies showed trends in physical activity, cultural variables, stress, and social cognitive variables for different student groups. Cumulatively, these studies provide evidence for several recommendations about how to better provide physical activity services and programming for Chinese international students in Canada to promote important mental health benefits.

1.2. International Students and Physical Activity

Regular physical activity has numerous physical and mental health benefits including reducing risks for chronic diseases (e.g., heart disease, diabetes), and improving psychological well-being (Frühauf et al., 2016; Warburton et al., 2010). For international students, participating in leisure time physical activity such as recreational sports and intramurals can help alleviate stress and pressure, improve social connections, maintain cultural identities, and explore new cultural identities (Allen, Drane, Byon, & Mohn, 2010; Brunette, Lariviere, Schinke, Xing, & Pickard, 2011). University students around the world have largely failed to meet physical activity guidelines (Haase, Steptoe, Sallis, & Wardle, 2004). Research in the United States that examined the processes of students adjusting to a new culture found that students from North America spent the most time being physically active, while students from Asian and African countries were the least physically active. Female international students were less physically active compared to male international and non-international students (Yoh, Yang, & Gordon, 2008).

Common barriers to engaging in physical activity for international students have been identified. Barriers include lack of English language skills, academic pressures, lack of time due to academic or other commitments, lack of social connections, discrimination, lack of confidence, shyness, lack of accessibility to information, and lack of convenient facilities (Brunette et al., 2011; Guo & Ross, 2014; Hashim, 2012; M. Z. Li & Stodolska, 2006; Shifman, Moss, D'Andrade, Eichel, & Forrester, 2011; T. Taylor & Doherty, 2005). Asian students in particular have identified that their focus on academic studies can leave little time and motivation for physical activity during their leisure time, and they preferred passive leisure activities (M. Z. Li & Stodolska, 2006). In Canadian and American studies that compared international and local students, non-international students reported more structural barriers (e.g., accessibility)

compared to international students, while international students reported more intrapersonal (e.g., confidence) and interpersonal (e.g., social relationships) barriers to physical activity and sport participation (Hashim, 2012; Shifman et al., 2011; Walker, Jackson, & Deng, 2007). Despite the barriers to sport and physical activity participation for international students, several positive outcomes associated with participating in recreational sport or physical activity have been identified. Intramural sports have been found to be effective in improving social networks and reducing feelings of loneliness for international students (Sawir, Marginson, Deumert, Nyland, & Ramia, 2007). Physical benefits (fitness, weight loss) and reducing stress were often emphasized by Asian international students (Brunette et al., 2011; Guo & Ross, 2014). Some research has also found that recreational sport and physical activity can be used as a means to learn and adapt to a new culture and/or maintain cultural identities (Allen et al., 2010; Brunette et al., 2011).

Some differences between international students in general and Asian international students have been found regarding both barriers and facilitators to physical activity. Guo and Ross (2014) examined Asian international students' campus recreational sports participation in the United States. In their study, lack of sport skills and shyness were not identified by Asian international students as barriers to their participation, although these barriers had been found in previous research examining mixed international student samples (cf. Shifman et al., 2011). Additionally, contrary to research by Allen et al. (2010), recreational sport was not identified as an avenue through which one could maintain or adopt a cultural identity. Home culture was found to be the least important barrier for Asian international students' participation in recreational sport; a finding that was incongruent with a mixed sample of international students (Guo & Ross, 2014). These differences highlight the importance of examining specific cultural groups and attempting to understand their experiences in context.

1.3. Cultural Considerations

1.3.1. Acculturation

The changes in an individual's attitudes, behaviours, values, and cultural identification as a result of movement from their original heritage culture along with prolonged and direct contact with a new and different mainstream culture is known as acculturation (Berry, 2005; Ryder, Alden, & Paulhus, 2000). A bi-dimensional model of acculturation has received ample empirical and theoretical support with diverse groups of acculturating individuals (LaFromboise, Coleman, & Gerton, 1993; Ryder et al., 2000; Ward & Rana-Deuba, 1999). The bi-dimensional model posits that an individual's heritage or mainstream cultural identities can vary independently rather than on a single continuum where the growth of one identity indicates a reduction of the other identity (Berry, 1997). Based on the bi-dimensional model of acculturation, four acculturation identities or strategies have been presented which describe the adjustment of an individual to a new culture (Berry, 1997). From the perspective of the non-dominant culture, *integration* involves the maintenance of both heritage and mainstream values; *assimilation* refers to the adoption of mainstream values while relinquishing heritage values or beliefs; *separation* is the maintenance of heritage values without adopting mainstream values; and *marginalization* refers to a disinterest in adopting the values, beliefs or preferences of either mainstream or heritage cultures (Berry, 1997).

These four acculturation types have been used to categorize acculturating individuals in previous research (e.g., Choi, Miller, & Wilbur, 2009); however, some researchers have also used this model to examine the two underlying dimensions of acculturation: mainstream and heritage identification (e.g., Hwang & Ting, 2008; Swagler & Jome, 2005; Ward & Rana-Deuba, 1999). In their research with Asian Canadians, Ryder et al. (2000) found that psychological

maladjustment was linked with a lack of identification with mainstream culture, while identification with heritage culture had little effect on participants' mental health. Ryder et al. concluded that mainstream acculturation was more important for understanding mental health than heritage acculturation and should be further explored. In terms of physical activity, Asian Americans who were more acculturated to mainstream culture engaged more in physical activity compared to those who were less acculturated to mainstream culture (Despues & Friedman, 2007). Therefore the two dimensional perspective may be appropriate when examining mental health and physical activity.

Researchers have found that acculturation can play a role in cognitions and representations of the self. Those who are more likely to hold strong public self-image worries (e.g., Japanese, Asian Canadians born in an East Asian country) were found to feel interpersonal dissonance when making a meal choice for a friend (and express more justification of their choice), whereas those typically less concerned about public self-image did not feel threatened by this choice and thus expressed less justification (e.g., European Canadians born in Canada). In addition, Asians in Canada who were fully acculturated to mainstream culture demonstrated an effect of personal affirmation (i.e., describing how a value uniquely describes who they are) in eliminating dissonance in the friend choice scenario, but Asians in Canada who were not acculturated were not affected by the personal affirmation, only the interpersonal affirmation (i.e., describing an important value for both themselves and their family members; Hoshino-Browne et al., 2005). These findings illustrate the relationships between conceptions of the self in relation to others and acculturation to a host culture.

1.3.2. Self-Construal

Another important variable related to culture, self-construal, has been found to vary as a function of acculturation, and could provide greater insight into behaviour and motivation (Berry, Poortinga, Segall, & Dasen, 2002; Ito, 2014; Landrine & Klonoff, 2004; Walker, Deng, & Dieser, 2005). Self-construal describes how a person understands themselves in relation to others around them (Walker, 2007). Markus and Kitayama (1991) posited that independent and interdependent are two overarching self-construals that influence psychological processes such as cognitions, motivations, and emotions. Independent self-construals are generally reflected in Western cultural contexts (e.g., Canada, USA) and they emphasize the distinction and separateness of people, expression of inner attributes, promoting personal goals, and self-assertion. People with independent self-construals primarily use their own thoughts and emotions to organize and provide meaning to their behaviour. Those with interdependent self-construals reference the feelings, thoughts, and behaviours of others to give meaning to behaviour (Markus & Kitayama, 1991). Interdependent self-construals are characteristic of those from Eastern cultural contexts such as Japan, or China. Interdependence means viewing oneself as a part of larger social relationships such that people are not separate from one another, collective welfare is paramount, and the needs and goals of significant others are important to maintain. Cross, Hardin, and Gercek- Swing (2011) described the two self-construals in terms of their prioritization of the individual (independent) or the group (interdependent). While certain cultures show patterns reflecting one type of self-construal, every culture encompasses some aspects of both types (Markus & Kitayama, 1991). Markus and Kitayama suggested that cultural context typically promotes development of an independent or interdependent self-construal more

strongly. As such, independent self-construal is more salient and supported in Westernized countries such as Canada.

Canadian and Chinese cultures have been examined with respect to leisure motivations and constraints, and the role of self-construal as a moderating variable (Hudson, Walker, Simpson, & Hinch, 2013; Walker, 2009, 2010). These studies used a framework developed by Triandis (1995) that describes four types of self that are combinations of horizontal (equality) or vertical (hierarchy) and individualist (independent) or collectivist (interdependent). These combinations can be conceptualized as four types of self-construal (see Figure 1.1 below). Combinations of these four types can be used to describe cultural expressions of the self. For example, Chinese are approximately 70% collectivist (30-40% horizontal and 30-40% vertical), and 30% individualist (15% horizontal, 15% vertical; Triandis, 1995). Vertical collectivists could be described as 'dutiful', as they desire to fulfill their role and achieve social cohesion. For horizontal collectivists, social cohesion occurs when people are equal and cooperative. Horizontal individualism is characterized by uniqueness, as personal differences exist, but not status differences. In vertical individualism, one would be achievement oriented and interested in personal and status differences (Hudson et al., 2013).

Walker, Jackson, and Deng (2008) used the framework described by Triandis (1995) to examine constraints (intrapersonal, interpersonal, and structural) to starting a new leisure activity (such as physical activity) for both Chinese and Canadian university students. Results for self-construal showed that while both groups were the same for horizontal collectivism, Chinese students rated vertical collectivism higher compared to Canadian students who were, in turn, higher on horizontal individualism. Interestingly, Chinese students were higher on vertical individualism than Canadian students. Walker and colleagues (2008) speculated this may be

related to China's economy, which is becoming increasingly competitive. As the authors expected, Canadians were found to differentiate on horizontal dimensions of self-construal while Chinese students varied more on the collective dimension. Two unexpected results in the Chinese group were that others' approval of an activity was perceived differently between vertical and horizontal collectivists and that for Chinese horizontal collectivists, low self-efficacy was a constraint for starting a new leisure activity in this group. The latter finding could have been because the students interpreted the survey questions in terms of collective efficacy (shared belief in a group's ability to produce an outcome; Walker et al., 2008).

In a sport specific context, Chinese-Canadian and Anglo-Canadian skiers' and non-skiers' self-construal and constraints were examined to understand the role of ethnicity and the lack of ethnic diversity in the sport (Hudson et al., 2013). Non-skiers who were vertical-individualists reported more intrapersonal and structural constraints, and skiers who were vertical-collectivists showed more interpersonal constraints. Both effects were more pronounced for Chinese-Canadians, and the authors speculated that vertical self-construals may have prevented non-skiers from garnering social benefits of participation because of an emphasis on competition. However, skiers who were vertical collectivists emphasized social bonds with friends and family (Hudson et al., 2013). The emphasis on social benefits of participation implies social motivations for participation, which is extremely relevant when examining physical activity from a social cognitive perspective in addition to examining self-construals.

	Interdependent	**Independent**
Hierarchy	Vertical Collectivism	Vertical Individualism
Equality	Horizontal Collectivism	Horizontal Individualism

Figure 1.1. Self-construal matrix (based on Hudson et al., 2013; Triandis, 1995)

1.4. International Student Transitions

International students often experience similar stressors to non-international students; however, they also deal with a host of unique sources such as the stress associated with acculturation, psychosocial adjustment, and sociocultural adjustment (Ward & Kennedy, 1999; Zhang & Goodson, 2011a). Several researchers have examined the factors associated with international student transitions, and many of the results are consistent with Berry's (2005a) bi-directional acculturation and adaptation framework, emphasizing social support, language skills, understanding new cultural norms, and participating in the broader university community as important factors in successful transitions by helping students become familiar with the host culture (McLachlan & Justice, 2009; Moores & Popadiuk, 2011; Smith & Khawaja, 2011).

Ward and Kennedy (1999) examined several studies using the Sociocultural Adaptation Scale to measure the sociocultural adaptation of sojourning samples connected to either Singapore or New Zealand. The authors proposed that there are two domains of cross-cultural adaptation pertaining to emotional or affective adaptation (i.e., psychological) or behavioural adaptation (i.e., sociocultural) to the host culture in such a way that well-being or satisfaction and a sense of ability to navigate appropriately in the host culture are achieved. Examples of psychological adaptation include personality, coping, and social support, while sociocultural

adaptation may include language, acculturation strategies, length of time in the host country, and contact with the host culture (Ward & Kennedy, 1993). The studies found that overall, adaptation problems were greatest during the early stages of transition, adaptation was easier the more ethnically and culturally similar a sojourner was to the host culture. Sociocultural adaptation may be easier in countries that are more developed, and some cultural groups may be more adaptable than others. For example, Singaporean students were better at adapting overseas compared to students from New Zealand, and this was suggested to be the result of intercultural skills and cultural knowledge gained through exposure to Eastern and Western people, media, values, and culture for those from Singapore (Ward & Kennedy, 1999).

International student adjustment was further reviewed by Zhang and Goodson (2011b) with regard to international students in the United States finding that psychological symptoms were more positive when students experienced less stress, more social support, had better English proficiency, and greater acculturation to the host culture. Acculturative stress was found to have similar correlates; however, women experienced higher acculturative stress. In terms of sociocultural stress, several predictors overlapped with psychological adaptation (i.e., language, acculturation) in addition to social contact with Americans, length of residence in the United States, and home country (e.g., European and South American students adjusted better than Asian students).

Enhancing the physical activity experiences of international students can aid in helping international students transition successfully to their host culture. Gómez, Urzúa, and Glass, (2014) examined international student adjustment in relation to social networks, acculturation, and leisure, and found that sports on campus and socializing off campus both predicted social adjustment to college in the United States. Acculturation also shared a positive relationship with

sports on campus, and off campus socialization, suggesting reciprocal relationships between acculturation, socialization, and sport participation. The authors recommended that schools or interventions should emphasize the physiological responses to stress, and the use of physical activity to mitigate the stressors related to practical, educational, or sociocultural factors (Smith & Khawaja, 2011). Related to these suggestions, intervention research examined the importance of stress on maintenance of physical activity in White, African American, Hispanic, and Asian college students and found that students who had lower stress, reported that their behaviour was influenced by the study, or were in the early stages of change were less likely to experience the typical decline in physical activity for new university students, or they increased their physical activity (Dougall, Swanson, Grimm, Jenney, & Frame, 2011). In other words, those who had lower stress received stronger effects from the intervention. Acculturation and acculturative stress should be considered when examining the physical activity patterns of international students and the specific relationships that exist need to be further examined, especially over time.

1.5. Transnationalism

It is important to acknowledge the status of transition that international students negotiate throughout their time away from their home countries. The theory of transnationalism recognizes that due to the potentially short-term nature of studying in another country, social, political, cultural, and economic affiliations are maintained in situations similar to those of international students (M. Z. Li & Stodolska, 2006). Positioning the present research within transnationalism allows an understanding that the experiences of international students are contextualized within their temporary status and this will influence their perceptions and participation in physical activity. The influence of transnationalism on the leisure behaviour of Chinese international

graduate students on the United States was shown in research by Li and Stodolska (2006). Their research found that leisure behaviour was not viewed as a primary focus for the students who felt that research and studying was more valuable in improving their career opportunities upon return to their countries of origin. Further, many students felt that due to the extra time spent on schoolwork, they had little free time which negatively influenced their mental state (M. Z. Li & Stodolska, 2006).

There are many environmental, behavioural, and personal factors that can influence an international student's choices about how to spend their leisure time. For example, a student could understand the benefits of physical activity for mental health; however, they may feel isolated and unwilling to participate without support from a friend. Consideration of these variables allows for the investigation of the antecedents of leisure time physical activity that can be targeted to promote this behaviour (Bandura, 2004).

1.6. Theoretical Framework: Social Cognitive Theory

Social Cognitive Theory (SCT; Bandura, 1986a) was first known as Social Learning Theory and re-named when cognitive psychology concepts were integrated to account for more comprehensive understanding of human information processing and biases that share relationships with experiential learning, observation, and symbolic communication (Bandura, 1986a). Social Cognitive Theory posits that behaviour is a product of the interactions between personal, behavioural, and environmental influences (i.e., triadic reciprocality). The theory aims to explain the motivation and regulation of behaviour through the core constructs of self-efficacy, outcome expectancies (i.e., physical, social, self-evaluative), social support, sociostructural factors (e.g., facilitators, impediments), and self-regulation (e.g., goals). One of the main assumptions of SCT is that people are agentic in that they intentionally influence their

functioning and life circumstances (Bandura, 2002). In the study of adaptive processes and adjustment to life circumstances, SCT has proven to be a versatile framework (Bandura, 1997, 2002).

Self-efficacy is a central component of SCT and refers to one's belief about their personal ability to perform behaviours that bring about desired outcomes. Self-efficacy can influence behaviour both directly and through other influences such as outcome expectancies, sociostructural factors, and self-regulation (Bandura, 2004, 1997). Those with higher self-efficacy report exercising more and higher self-efficacy is related to better persistence, especially when facing challenges or setbacks (Bandura, 2004, 1997, 1986b; Dishman et al., 2005). Regardless of actual skill, self-efficacy is one's confidence they can perform a specific behaviour (e.g., exercise) under certain circumstances (e.g., in a crowded gym) that are complex and ever changing (Bandura, 1997). Furthermore, general behaviours such as physical activity require several other smaller behaviours such as selecting appropriate attire, learning skills or sports, or registering for programs, and as such self-efficacy is required for both mastery and regulation of behaviour (Bandura, 1997; Rodgers, Wilson, Hall, Fraser, & Murray, 2008).

Outcome expectancies are the anticipated costs and benefits of adopting certain behaviours (Bandura, 2004). These expectancies can manifest as physical, social, or self-evaluative outcomes which can be positive or negative and occur in the short or long term (Luszczynska & Schwarzer, 2005). Self-efficacy can influence behaviour both directly and indirectly through outcome expectancy, and outcome expectancy is thought to predict little additional variance compared to self-efficacy when outcomes are closely linked with behaviour (Bandura, 1997). Outcome expectancies require and are included in self-efficacy because an individuals' belief that they can produce the responses needed for the desired outcomes can play

a role in behaviour. For example, although a person believes that quitting smoking will help improve their heart health, they may not believe that they have the ability to quit smoking (Luszczynska & Schwarzer, 2005). D. M. Williams (2010) argued, however, that outcome expectancies could causally influence behaviour, citing several examples of research demonstrating and defending this point (e.g., Corcoran, 1995). Specifically, for behaviours such as exercise, which are within our physical capabilities, but may lead to adverse feelings in the near future, people may have negative outcome expectancies anticipating these adverse feelings and choose not to engage in the behaviour (Corcoran, 1991, 1995).

Social support is perceived support for behaviour from significant others in one's life. Specifically, in exercise research, it has an indirect effect on behaviour through self-efficacy as opposed to a direct relationship, and it is noted as an important way to enhance self-regulation. Social support can include things like modelling behaviours, support from an exercise partner, or an instructor offering feedback during a workout class (Bandura, 1997). Social connections with others are highly valued in East Asian cultural contexts, and therefore acts that enhance these social bonds can enhance self-esteem (Kitayama, Duffy, & Uchida, 2007). For this reason, social support may play an exceptionally important role with Chinese international students. Researchers have found, however, that asking for social support during stressful times may be less likely among those who endorse an interdependent self-construal because of a desire not to burden important relationships and maintain social harmony (S. E. Taylor et al., 2004). Social support could therefore be a complicated correlate of physical activity for Chinese students.

Sociostructural factors can directly or indirectly influence behaviour and include barriers or facilitating factors that occur in systems (e.g., health, political, economic, environmental) and living conditions (Bandura, 1997). The perception and appraisal of opportunities and

impediments in the environment are controlled by efficacy beliefs, and can impact short-term goals to engage in health behaviour (Bandura, 1982, 2004).

Self-regulation includes self-monitoring, goal setting, feedback, rewarding oneself, instructing oneself, and recruiting support from social relations (Bandura, 1997). Regulating the self encompasses the capacity to tolerate negative outcomes if they will lead to valuable positive long-term outcomes (Karoly, 1993). Proximal goals are required to facilitate motivation and guides to behaviour. People monitor their behaviour and gauge their achievements based on the goals they set for themselves. Efficacy can help determine the types of goals a person sets, and their evaluation of their achievement, but they also make contributions to performance (Bandura, 1998).

In SCT, there are three modes of agency, which are all required for successful functioning: direct personal agency, proxy agency which is socially mediated (i.e., one relies on others to act on their behalf to reach a goal), and collective agency that requires group action. Importantly, this blend may vary by culture, but this is also what makes SCT applicable to both individualistically and collectivistically oriented social systems (Bandura, 2002). Bandura (2002) suggests that agency is not exclusive to individual or collective modes, but the relative emphasis on agentic types can describe cross-cultural variation in human agency. Furthermore, regardless of one's self-concept, personal efficacy is imperative to both group and self-directedness because success can be achieved individually, or as a function of personal capabilities contributing to group outcomes. Collective efficacy (belief in a group's capability to achieve an outcome) is therefore enhanced when perceived personal efficacy is enhanced and everyone can contribute to the group outcome by performing their role. As such, efficacy (personal and collective) is a mechanism of agency in SCT, and can foster influence on one's social system as opposed to

simple reactions to it. Efficacy beliefs have also shown cross-cultural comparability in both structure and functional properties (Bandura, 2002).

1.6.1. Social cognitive theory and physical activity

Many researchers have investigated the social cognitive correlates or determinants of physical activity in diverse populations. In an adult model, age, race, social support, self-efficacy, and self-regulation were related to physical activity, but physical and time-based outcome expectancies were not (Anderson, Wojcik, Winett, & Williams, 2006). Age had the strongest total relationship with physical activity, and African Americans had lower physical activity levels compared to the rest of the sample (79% White). Indirect effects were found for social support, which acted through self-efficacy and self-regulation. Self-efficacy effects were direct but diluted because of their strong effect on physical outcome expectations. Outcome expectations showed an overall non-significant effect on physical activity. Self-regulatory behaviours had the strongest effect on physical activity. These findings suggested that self-efficacy had little effect on physical activity when measured independent of self-regulatory behaviours (Anderson et al., 2006). Similar results were found in another adult sample (Ayotte, Margrett, & Hicks-Patrick, 2010) in which self-efficacy was directly and indirectly related to physical activity through outcome expectancies, perceived barriers, and self-regulatory behaviour. The relationship between social support and physical activity was almost fully indirect; social support was related to self-efficacy and self-regulatory behaviour, and through self-efficacy, social support was indirectly related to outcome expectancies and self-regulatory behaviours (Ayotte et al., 2010).

Other research in samples of college students found that vigorous physical activity (measured with accelerometers) was predicted by self-efficacy for overcoming stressful and

interpersonal barriers and challenging physical activity goals (Doerksen, Umstattd, & McAuley, 2009). Interestingly, outcome expectancies were unrelated to physical activity which the authors suggested may be due to the overriding effect of self-efficacy (Bandura, 1997). The same overriding effect of self-efficacy was found in another college sample which used structural equation modelling to examine relationships between social cognitive variables and self-reported physical activity (Rovniak, Anderson, Winett, & Stephens, 2002). Again, exercise self-efficacy had the largest effect on physical activity directly and through self-regulation, and social support was indirectly related to physical activity through self-efficacy. Other researchers found that during a 12 month exercise program outcome satisfaction (i.e., feeling that the outcome was fulfilling) was reciprocally related to coping and scheduling self-efficacy and these relationships were stronger than reciprocal relationships with task self-efficacy. Additionally, program attendance depended on task self-efficacy in the early stages, outcome satisfaction in the middle stages, and coping self-efficacy in the latter stages of the program, acknowledging the important dynamics at play over time in these variables (Selzler et al., 2018). Many studies examining SCT are limited by a lack of ethnic representation, and more diverse samples have been called for by researchers (Rovniak et al., 2002).

There has been limited research in ethnically diverse groups examining the SCT correlates of physical activity. One study, comparing a sample of young adults who were Hispanic and White, found that among Hispanics, task efficacy, perceived latency to cardiovascular exercise conditioning effects, and self-evaluative, and mental-health expectancies predicted activity levels, but for the White groups scheduling efficacy and self-evaluative expectancies were the only SCT predictors (M. P. Ryan, 2005). Physical health outcome expectancies for cardiovascular exercise differed between the groups such that Hispanics

perceived a greater time investment to gain exercise benefits and more strongly expected health benefits from exercise on cardiovascular disease and Type II diabetes compared to the White group. Other research with diverse ethnic groups did not compare them to White samples, but demonstrated that the SCT variables can manifest in different ways depending on ethnicity. For example, research with Latinos found that those with higher leisure time physical activity had greater barriers self-efficacy (largest effect), social support from friends, and belief in the importance of physical activity compared to those with low leisure time physical activity (Marquez & McAuley, 2006). This study, however, did not measure other SCT variables such as outcome expectancies and self-regulation. These variables were included in a sample of Iranian female adolescents with the aim of explaining physical activity, finding results similar to previous research with primarily White samples, where social support was only indirectly related to physical activity through self-efficacy and outcome expectations (Taymoori, Rhodes, & Berry, 2010). Self-efficacy and outcome expectations had direct relationships with physical activity, and self-efficacy was indirectly related to physical activity through outcome expectations and self-regulation. The role of self-efficacy as a moderating variable on planning was explored in a sample of Chinese adolescents (Luszczynska et al., 2010). Specifically, the role of planning as a mediator between intentions to be physically active and physical activity behaviour was moderated by self-efficacy.

In one of the few interventions using SCT with a non-Western population, Sriramatr, Berry, and Spence (2014) conducted an internet-based intervention with female students in Thailand using a SCT framework. Physical activity, self-efficacy, self-regulation, and outcome expectations were higher in the intervention group and these increases were maintained at 6-month follow-up. The importance of culture on the results was highlighted by Sriramatr and

colleagues (2014) in several instances such as the maintenance of the results by the Thai female students following the internet intervention, a finding that supported previous intervention research (Huang, Hung, Chang, & Chang, 2009). Conversely, female students in North America have not shown evidence of physical activity maintenance after internet interventions (Wadsworth & Hallam, 2010). Sriramatr et al. (2014) suggested that the maintenance of physical activity observed following their intervention may be due to the interdependent nature of the Thai students who have lower attrition rates compared to Western students, or it could be that the SCT variables which are focused on the social nature of humans may share stronger psychological relationships with the interdependent Thai students than the more independent Western students. In line with the current research proposal, Sriramatr and colleagues suggested that this link between SCT variables, culture, and physical activity maintenance requires additional examination. Although interventions such as theirs can help researchers to understand how physical activity can be influenced in non-Western university students, there is a need to delineate the complexities of self-construal, acculturation, acculturative stress, and social cognitive variables on physical activity of international students in Canada.

1.7. Outcomes of Physical Activity: Subjective Well-being

Subjective well-being is defined by Diener and Ryan (2009) as "an umbrella term used to describe all levels of well-being people experience according to their subjective evaluations of their lives" (pg. 391). From a hedonic perspective, subjective well-being involves frequently feeling pleasant emotions, infrequently feeling negative emotions, and life satisfaction (Diener, 1984; Tov & Diener, 2007). In their overview, Diener and Ryan (2009) identify four domains that are improved by subjective well-being; health and longevity, work and income (e.g., earn more money), social relations (e.g., better self-confidence, sociability), and societal benefits

(e.g., volunteer for community or charity groups; Diener & Chan, 2011). In addition, positive psychological well-being has been linked with cardiovascular health (Boehm & Kubzansky, 2012). Physical activity has shown associations with increased subjective well-being, happiness, life satisfaction, and reduced depressive symptoms (Caunt, Franklin, Brodaty, & Brodaty, 2012; Grant, Wardle, & Steptoe, 2009; Motl et al., 2005; Puig-Ribera et al., 2015; Wang et al., 2012). Longitudinal analysis of the National Population Health Survey in Canada found that leisure time physical activity was associated with reduced odds of unhappiness, and those who remained inactive were more likely to become unhappy compared to those who became active, suggesting that mood status could be associated with changes in leisure time physical activity (Wang et al., 2012).

The cultural nuances of subjective well-being and emotion have been examined and it has been found that self-construal may play a role in how desirable certain emotions are (Markus & Kitayama, 1994). For example, feelings of pride highlighting individual achievement are undesirable and experienced less in collectivist cultures (e.g., Chinese) because they can result in a separation of the individual from their social referent group. On the other hand, collectivist cultures may experience and embrace feelings of sympathy and humility which are in line with their cultural norms. The difference between emotions perceived as pleasant and unpleasant (affect balance) was found to correlate positively with life satisfaction for 40 nations, with stronger correlations in the individualistic nations (Suh, Diener, Oishi, & Triandis, 1998). This relationship highlights the importance in understanding what constitutes positive or good emotions, which can vary by culture. For example, in addition to valuing low-arousal positive affect, Asians show a greater acceptance of unpleasant emotions compared to people in the Americas (Diener & Suh, 1999; Tsai et al., 2006). The norm of accepting the middle way of

extreme emotions is shown by positive correlations in Japan between preferences for pleasant and unpleasant affect (Kitayama, Markus, & Kurokawa, 2000). In other research, Asian and Asian Americans experienced less positive affect compared to European and Hispanic Americans; however, Asians and Asian Americans were not biased in the direction of negative affect (Scollon, Diener, Oishi, & Biswas-Diener, 2004). Interpretation of measures of emotion and subjective well-being need to account for cultural norms, and the role of self-concept in shaping what is perceived as a desirable affective state.

1.8. Overall Purpose

Many Chinese international students are less physically active compared to non-international students (Yoh et al., 2008). Research has shown that in addition to physical health benefits, physical activity could help Chinese international students adjust to life in a new country through decreased acculturative stress (Smith & Khawaja, 2011).

The aim of the current research is to use social cognitive theory to examine the sociostructural, cognitive, and cultural correlates of leisure time physical activity for mainland Chinese international students throughout their study period in Canada, and to understand how physical activity is related to subjective well-being, general stress, and acculturative stress for this population. The current research project included a three-stage investigation of the leisure time physical activity experiences of mainland Chinese international students in Canada.

1.8.1. Significance

This research provides a better understanding of how leisure time physical activity (LTPA) is related to subjective well-being, general stress, and acculturative stress for mainland Chinese international students in Canada. By translating and examining the factor structures of instruments used to measure social cognitive, physical activity, and mental health variables we

provided valuable insight for cross-cultural psychologists and theorists on the transferability of the instruments across cultures. Furthermore, measurement of students at two time points and between first year and senior students allowed an understanding of the changes in the relationships between social cognitive variables and leisure time physical activity in addition to the mental health outcomes of leisure time physical activity for Chinese international students over time. If leisure time physical activity can be used as a vehicle for improved mental health among mainland Chinese international students, their international student experience can be enhanced. Furthermore, strategies focused on relevant SCT correlates could be developed to encourage Chinese international students to be physically active. A fuller picture of the experiences of Chinese international students could illuminate the changes that occur throughout one's undergraduate degree, and help identify specific needs that arise for at different stages of their degree.

1.9. Measures

The following measures were included in all three studies. See Appendix A for a chart reviewing which measures were excluded from study one, and study two, time 2. Appendix B and C include the instruments as they were presented to the participants. All measures were translated into simplified Chinese, and some were modified following the exploratory factor analysis (EFA) conducted in study one, part I. The following descriptions reflect the changes that were made because of the EFA. All measures were adjusted to reflect a week-long recall time-frame to remain consistent with the measure of physical activity.

Demographic variables

Age and sex (male = 1, female = 2) were assessed using one question for each variable. Self-reported weight and height were used to calculate body mass index (BMI) in kilograms per meter squared. Students also reported program of study, year of study, previous experience with sport and exercise, and home region in China. The students in Canada were asked about their plans to finish their degree in Canada or remain in Canada after their degree is finished (study two and three).

Language

Participants reported self-rated English proficiency (rated from 1 [very low] to 7 [extremely high]) using four items (one for perceived reading, writing, speaking, and listening; Xu, 1991) created by the primary investigator.

Leisure time physical activity

The International Physical Activity Questionnaire-short version (IPAQ) was used to assess self-reported physical activity over the last seven days. Days per week and hours/minutes per day of vigorous (e.g., heavy lifting, aerobics), moderate (e.g., doubles tennis, regular biking),

walking, and sitting. Continuous scores are expressed in metabolic equivalents of a task (MET; the energy cost of physical activities). Walking, moderate physical activity (MPA), and vigorous physical activities (VPA) are assigned 3.3, 4.0, and 8.0 METs, respectively. These MET values are multiplied by number of minutes and days for each activity to calculate a MET score per week for each type of activity. The Chinese version of the IPAQ (IPAQ-C) was found to be reliable (interclass correlation coefficient =.79) and showed agreement with a week-long physical activity log (Macfarlane, Lee, Ho, Chan, & Chan, 2007).

Self-efficacy

Self-efficacy for exercise was assessed using the multidimensional exercise self-efficacy scale (MSES; Rodgers et al., 2008) which measures three dimensions of self-efficacy; task, coping, and scheduling. Task self-efficacy refers to confidence in physically performing the behaviour, coping self-efficacy is the belief in one's ability to overcome challenges in order to perform the behaviour, and scheduling self-efficacy is the confidence in one's ability to plan effectively to add the behaviour into a daily/weekly schedule. The MSES includes nine items (three items for each type of self-efficacy). Items are rated from 0% (not at all confident) to 100% (completely confident). Each item begins with the stem "How confident are you that you can…" followed by "…complete exercise using proper technique" for task self-efficacy. An example of coping self-efficacy would be "…exercise when you lack energy," and scheduling self-efficacy would read "…include exercise in your daily routine." Subscales are calculated by taking the mean of items 1, 2, and 6 for task self-efficacy, 3, 7, and 8 for coping self-efficacy, and 4, 5, and 9 for scheduling self-efficacy. Rodgers and colleagues (2008) found that these items were reliable in undergraduate students (task $\alpha = .81$, coping $\alpha = .81$, scheduling $\alpha = .91$), the three factor structure was supported using CFA, and changes in each domain were different

after 12 weeks suggesting independent sensitivity to contextual factors. The scale had an overall reliability of α = .94 that was calculated after the EFA with the Chinese version of the MSES. This EFA revealed a single factor explaining 67.5% of the variance.

Intention

Participants responded to the question, "I intend to do moderate physical activity for 150 minutes in the next week" from 1 (likely) to 7 (unlikely) which can act as an indication of one's plans to regulate their physical activity behaviour (Karoly, 1993; Luszczynska & Schwarzer, 2005).

Social support

The Friend Support for Exercise Habits Scale (Sallis, Grossman, Pinski, Patterson, & Nader, 1987) includes 5 items that measure social support from friends for exercise during the past week (altered from one month in the original version). Scales range from 1 (never) to 5 (7 or more times). The items are: "exercised with me," "offered to exercise with me," "gave me helpful reminders to exercise," "gave me encouragement to stick with my exercise program," and "changed their schedule so we could exercise together." Good internal consistency was found α = .91 (Rovniak et al., 2002). The single factor was supported in study one which had an internal consistency of α = .82.

Accessibility

Perceptions of accessibility to opportunities to be physically active at the university and in the community were collected using two questions created for this research, "Does your university offer you opportunities to participate in physical activity in your spare time?", and "Are there opportunities to participate in physical activity in your spare time outside of your

university?" rated from 1 (never) to 7 (all the time). These items were combined to generate an average accessibility score.

Self-construal

Participants completed a 20-item scale (Park & Kitayama, 2012) rating their agreement with each statement on a 7-point scale from 1 (strongly disagree) to 7 (strongly agree). Ten items represent an "interdependent" subscale, and 10 items represent an "independent" subscale. An example question from the interdependent subscale is, "I am concerned about what people think of me." The independent subscale includes items such as, "I always try to have my own opinions." The scale yielded scores for interdependent and independent self-construal and has shown internal consistencies of $\alpha = .66$ and $\alpha = .78$, respectively for a sample of Japanese, Asian Canadians, and European Canadians (Ito, 2014). Four items were removed following the EFA due to low factor loadings on multiple factors, and consultation with one of the bilingual translators. The final scale included 16 items (9 representing an independent self-construal, and 7 representing an interdependent self-construal). The independent and interdependent subscales had reliability coefficients of $\alpha = .83$, and $\alpha = .72$, respectively in study one of this dissertation.

Acculturation

The Vancouver Index of Acculturation (VIA; Ryder et al., 2000) includes 20-items measuring identification with and participation in heritage cultural practices (i.e., Chinese, 10 items) as well as typical mainstream practices (i.e., Canadian, 10 items) independently. Items change only in their reference to culture and reflect values, social relationships, and adherence to traditions. For example, a heritage subscale item is "I often participate in Chinese cultural traditions". The corresponding mainstream culture subscale "I often participate in mainstream Canadian cultural traditions". The items are rated on a 9-point Likert rating scale ranging from 1

(strongly disagree) to 9 (strongly agree). The heritage (α = .91) and mainstream (α = .89) subscales have shown good reliability with Chinese undergraduates (Huynh, Howell, & Benet-Martinez, 2009). In study two, reliability was α = .93, and α = .82 for the heritage and mainstream subscales, respectively.

Acculturative Stress

Bai (2016) developed the Acculturative Stress Scale for Chinese College Students in the United States (ASSCS). Items were altered to refer to Canada instead of the United States. It contains 32 items measuring five factors; language insufficiency (10 items; e.g., "I hesitate to participate in class discussion and seminar"), social isolation (8 items; e.g., "My social circles shrank after I came to Canada"), perceived discrimination (7 items; e.g., "I feel that I receive unequal treatment"), academic pressure (4 items; e.g., "I feel a lot of academic pressure"), and guilt towards family (3 items; e.g., "I worry about my parents"). Items are rated from rated from 1 (never) to 7 (all the time). In a sample of Chinese students in the United States, the measure had an overall internal consistency of α = .93 (Bai, 2016), and it was similar in the data collected from Chinese students in study one (α = .91).

Subjective Well-being (SWB)

The life satisfaction aspect of SWB was assessed using The Satisfaction with Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985). Item 5 ("If I could live my life over, I would change almost nothing") was removed based on the EFA results, and because this item may not be accurate in a young sample. Each item is rated on a 7-point scale (1 [strongly disagree] to 7 [strongly agree]). For example, one item states, "In most ways my life is close to my ideal". The reliability of the scale in the same from study one was α = .89.

Actual affect. The Affect Valuation Index (AVI; Tsai et al., 2006) assessed the affective portion of SWB (actual affect only). Participants rated how often they actually have each feeling over the course of a typical week (30 feeling words total) from 1 (never) to 5 (all the time). The items were sampled from the affective circumplex (Watson & Tellegen, 1985; Yik & Russell, 2003) which includes eight emotion 'octants'. Only items in the positive (8 items; $\alpha = .87$), negative (9 items; $\alpha = .83$), and low arousal positive (3 items; $\alpha = .79$) octants were included in the present analyses based on the EFA and to remain consistent with SWB criteria (Diener & Ryan, 2009). Some examples for positive affect include excited and happy, while negative affect words would include dull and hostile. Low arousal positive words were calm, serene, and peaceful. Making a distinction between low arousal positive and positive affect is valuable in a Chinese population as they may prefer low arousal positive emotion in their leisure activities compared to Western cultures (Tsai, 2007).

A composite SWB score was calculated by summing average scores from the SWLS, positive affect frequency, and low arousal positive frequency. Average negative arousal frequency was then subtracted from the total. Higher scores indicated better SWB. This calculation was novel in this research and was done to align with Diener and Ryan's (2009) conceptualization of SWB as having more frequency of positive affect, less negative affect and high life satisfaction. The single calculated factor fit the model in Study one, part III, but adding the single indicators separately (low arousal, positive arousal, low arousal positive, life satisfaction) did not fit the data. As reported in section 2.8., the latent structure of the construct was used to estimate SWB. Researchers have examined the aspects of SWB separately (i.e., positive affect, negative affect, and life satisfaction; (Schueller & Seligman, 2010; Wiese, Kuykendall, & Tay, 2018), however, there is no theoretical agreement or adequate empirical

support for any specific measurement model of SWB (Schimmack, 2008). Therefore, we decided to calculate a single indicator of SWB considering Diener's (2009) definition. This calculation also allowed the inclusion of low arousal positive emotions into the equation, which may contribute to SWB for Chinese students.

Perceived stress

The Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983) includes 10 items that require participants to rate the frequency of certain thoughts or feelings in the past week (altered from past month) in relation to positive and negative life events rated on a scale from 1 (*never*) to 4 (*very often*). For example, one negative perception question asks, "how often have you been upset because of something that happened unexpectedly?" A positive item reads, "how often have you felt that you were on top of things?" Positive items are reverse scored, and the sum of the items indicates a stress level. The negative subscale showed a reliability of α = .82, and the positive items showed a reliability of α = .67 in the Chinese sample from study one.

Exercise to reduce stress

This construct was measured with three of four items from the stress management subscale of the Exercise Motivations Inventory II (Markland & Ingledew, 1997). One item was removed during translation into simplified Chinese. An example item is "Personally, I exercise, (or might exercise) to help manage stress" rated from 0 (not at all true for me) to 5 (very true for me). In the Chinese sample the internal reliability was α = .91.

Chapter 2: Study One

Investigating the validity and reliability of social cognitive theory, culture, and mental health instruments translated into Chinese

2.1. Introduction

Comparisons of American and Chinese university student physical activity showed that American students were more active than Chinese students, and men overall were more active compared to women (W. Chen, 1998). Interestingly, while American women were motivated to exercise for weight management, Chinese women were motivated by opportunities for social interaction (W. Chen, 1998). For adults in China, prevalence of leisure time physical activity for health benefits was low in both rural (28.9%) and urban (7.9%) regions (Muntner et al., 2005). Research has shown that Tai Chi interventions can aid in improving mental health for Chinese students (Wang, Taylor, Pearl, & Chang, 2004), and Korean nursing students who did Tai Chi had reduced fatigue, anxiety, and better sleep compared to the control group (Park & Kim, 2016).

Variables that help explain motivations and cognitions for physical activity in a mainland Chinese population would therefore be beneficial to explaining the mechanisms that support participation in physical activity to promote the behaviour. Social cognitive theory (SCT; Bandura, 1986a) has been touted as a versatile theory in explaining behaviour through its interaction with personal and environmental factors (Bandura, 1986a). Self-efficacy (behaviour specific confidence) is one of the main correlates of exercise behaviour (Bandura, 1997; Rovniak et al., 2002). In addition, social support, and self-regulation have been shown to play a role in physical activity adherence (Annesi, 2004).

Despite the utility of SCT, there have been few studies examining the constructs in relation to exercise in East Asian cultural contexts. In one of the only studies of its kind (published in English), Sriramatr and colleagues (2014) conducted an internet intervention using SCT constructs with female Thai university students. Self-efficacy, outcome expectations, and self-regulation were increased following the intervention, and were maintained at a three-month follow-up. These results differed from interventions conducted in the West, and the authors proposed stronger relationships between the self and SCT variables for the Thai students. Prior to beginning the intervention, the instruments used to measure self-efficacy for exercise (Multidimensional Self-efficacy for Exercise Scale; Rodgers et al., 2008), outcome expectations (Outcome expectations questionnaire), and self-regulation (Self-regulation Questionnaire; Sriramatr et al., 2013) were translated into Thai and validated for use in the intervention study. This step is extremely important, especially when using instruments developed in Western contexts (i.e., an imported approach) to examine concepts related to self-concept, emotion, and motivation (Yik, 2010).

The purpose of the current study was to translate and validate the testing instruments that were utilized in studies two and three, and to identify any practical or theoretical issues with the research design. Following validation, the relationships between variables of interest were also examined using the sample of Chinese students in this study (parts II and III). Collecting data in China avoided contamination of the data as it was not used in the studies two and three, and the participants were only sampled for this study (van Teijlingen & Hundley, 2001). The research questions of interest included:

1. What is the factorial validity and reliability of the proposed instruments (see Appendix B) after translation with a university student sample from mainland China?
2. Is the proposed research method feasible for this population?
3. What are the relationships between self-efficacy, social support, intentions, perceived accessibility, self-construal, and leisure time physical activity participation for mainland Chinese university students?
4. Does leisure time physical activity share a relationship with subjective well-being, and perceived general stress for Chinese university students?

A secondary outcome of the proposed data collection in Hangzhou was the opportunity to interact with the population of interest and learn about their culture first hand. Cultural immersion has been identified as a primary method in the development of culturally appropriate research instruments (Marín & Marín, 1991). As a researcher born in Canada, this experience was invaluable to the research process, and added considerably to the interpretation of the main research study data through increased awareness and sensitivity to the nuances of Chinese culture.

2.2. Methods

Instrument. Participants completed a modified questionnaire package (removing acculturation and acculturative stress scales; Appendix B). Please see the Measures section (1.9) for descriptions of each of the questionnaires.

Procedures and data analyses. The questionnaires were translated and analyzed based on the recommendations by Marín and Marín (1991) which includes three steps; 1) back translation and committee approach, 2) test-retest procedure (n = 20; Banville, Desrosiers, &

Genet-Volet, 2000), and 3) exploratory factor analysis (EFA; Comrey & Lee, 2013). Test-retest was done with only the Chinese versions of the survey because it was not reasonable to burden participants with doing a long survey package twice, in two languages with little incentive. All participants completed the survey online. The questionnaires (Appendix B) were translated into simplified Chinese by three bilingual doctoral students using a committee approach (Marín & Marín, 1991). The questionnaires were split into three sections. Each translator translated their section into simplified Chinese. Next, translated questionnaire sections were checked by another member of the group who had not done the initial translation. Any questions or problems were worked out amongst the researcher and the translators. Each section was then translated back to English by a translator who had not been involved in the section previously. Lastly, the original and back-translated versions of the questionnaires were compared by the primary researcher and her supervisor. For the second step and third steps of the translation process participants completed the questionnaire package online at two time points (one week apart), or at one time point.

Ethics approval was obtained from the University of Alberta prior to data collection in China. Ethics approval was not required from Zhejiang University to collect data in China. Data were collected from students in the library and open study spaces at Zhejiang University in Hangzhou, China. Potential participants were asked if they were undergraduate students, and if they could participate in the study. Students who agreed to participate either scanned the QR code using a mobile device or input the website address on their computer to access the survey online. Participants read an information letter about the study and passively consented by beginning the questionnaire. Data were collected on the Sojump.com survey platform. Students

completing the test-retest were contacted one week after their first session via email to complete the questionnaire a second time.

2.3. Study One, Part I: Validity and reliability

2.3.1. Data Analysis

Data analyses were conducted using SPSS version 24. Descriptive data were first examined to confirm appropriateness of the data for factor analysis. Missing data were excluded listwise, and participants with data considered to be outlying ($z < |3.29|$) were excluded from the analyses. Next, principal components analysis was used to extract the factors. Factor retention was based on the Keiser-Guttman rule (eigenvalues >1) and scree plots. Direct oblimin rotation was used where necessary. Finally, internal consistency coefficients (Cronbach's α) for items retained in the EFA were calculated.

The exploratory approach was chosen because translation of questionnaires, and use of these questionnaires in diverse cultural contexts can lead to alternate factor structures than expected in a confirmatory factor analysis (CFA), which would be more suited to a testing a hypothesis (Gerbing & Hamilton, 1996).

Intraclass correlation coefficients (ICC) estimates were calculated to examine test-retest reliability using a separate sample. The calculations were based on mean ratings of the subscales at each time point, absolute agreement, and two-way mixed effects model.

2.3.2. Participants

The sample used for the EFA comprised 323 undergraduate students from mainland China studying at Zhejiang University in a variety of subjects. Of the 308 students who reported their year of study, 129 were in their first year, 76 were in second year, 63 were in their third

year and 40 reported being in their fourth year. The average age was 20.26 years ± 1.84, and the sample was 54.8% female.

2.4. Exploratory Factor Analysis Results and Discussion

See Tables 2.1-2.6 for details of the exploratory factor analyses for items in each scale.

2.4.1. Multidimensional Exercise Self-Efficacy Scale (MSES)

The MSES includes nine items comprising a three factor structure. This structure has been supported in previous studies with the English version of the questionnaire (Rodgers et al., 2008; Sriramatr et al., 2013). These factors are coping (items 3, 7, 8), scheduling (items 4, 5, 9), and task self-efficacy (items 1, 2, 6). Task self-efficacy refers to confidence in performing the actual behaviour, coping self-efficacy is the belief in one's ability to overcome challenges to perform the behaviour, and scheduling self-efficacy is the confidence in one's ability to plan effectively to add the behaviour into a daily/weekly schedule. Items are rated from 0 (not at all confident) to 100% (completely confident). The instrument begins with an explanation of moderate physical activity, and instructions, "Moderate intensity physical activity (MPA) includes activities such as fast walking, basketball, tennis, easy bicycling, and swimming. It is recommended that adults complete 150 minutes of MPA per week. Please indicate your confidence that you can complete the recommended amount of physical activity in the following situations from 0 – 100%". Each item begins with the stem "How confident are you that you can perform MPA when…" which for example, would be continued with "…complete exercise using proper technique" for task self-efficacy. An example of coping self-efficacy would be "…exercise when you lack energy" and scheduling self-efficacy would read "…include exercise in your daily routine". Rodgers and colleagues (2008) found that these items were reliable in Canadian undergraduate students (task $\alpha = .81$, coping $\alpha = .81$, scheduling $\alpha = .91$).

Preliminary analyses suggested the data were appropriate for EFA with the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy = 0.911 for the participants with no missing data (n = 312). Bartlett's test of sphericity was also acceptable (χ^2 = 2356.74, df = 36, p < .001). One factor was shown with the principal component analysis (eigenvalue = 6.07), and inspection of the scree plot confirmed this unidimensionality. The factor explained 67.52% of the variance and had an internal consistency of α = .94. Correlations of the items with the single factor average ranged from .77 - .88 suggesting the single factor is a good estimation of the structure.

The single-factor finding is contrary to the three-factor structure described and confirmed by Rodgers et al. (2008). The act of engaging in physical activity often requires several intermediary skills from learning to perform the behaviour properly, planning out one's time, and choosing one behaviour over another. Self-efficacy required for these skills is logically also varied (Bandura, 1997). In this measure the task, scheduling, and coping subscales were not different enough to warrant multiple factors. This could have been an issue stemming from translation in which the semantic differences between the items were not maintained. It could also reflect Chinese perspectives of self-efficacy. Perhaps Chinese students do not differentiate between nuanced types of self-efficacy in the physical activity context. However, the mean scores of the items from the coping subscale indicate that distinctions were made between the coping subscale and the remaining task and scheduling subscales. It is possible that multiple types of self-efficacy for physical activity exist for Chinese university students, but the current measure failed to distinguish these. For example, a coping item may include performing MPA when family or friends discourage the activity. More interdependent who tend to place importance on social harmony may identify social pressure as a barrier.

Table 2.1.

A principal analysis and pattern matrix of the simplified Chinese version of the Multidimensional Self-Efficacy for Exercise Scale

Item number	Item abbreviations	M	SD	Factor I
1	…follow directions to complete MPA…	74.88	25.81	.74
2	…perform all activities required for complete MPA.	68.60	26.61	.80
3	…perform MPA…when you don't feel well…	43.73	27.65	.75
4	…arrange your schedule to include MPA…	63.07	27.18	.83
5	… consistently perform MPA…	59.04	28.73	.87
6	… complete MPA using proper technique.	62.05	26.61	.79
7	…perform MPA…when you lack energy.	42.67	27.98	.78
8	…perform MPA…when you feel discomfort.	38.00	26.86	.74
9	…include MPA… in your daily routine.	54.89	29.88	.86

Note. Items were rated on a scale from 1- 100. MPA= moderate physical activity. All items followed the stem "how confident are you that you can…".

2.4.2. Friend Support for Exercise Habits Scale

This social support scale includes five items indicating how often in the past week a friend has done something to support their exercise. Scales range from 1 (never) to 5 (7 or more times). An example item is "In the past week, a friend exercised with me". Internal consistency has been reported as $\alpha = .91$ (Rovniak et al., 2002). The unidimensional structure was supported in previous research with an English (Sallis, Grossman, Pinski, Patterson, & Nader, 1987) and Persian version of the scale (Noroozi, Ghofranipour, Heydarnia, Nabipour, & Shokravi, 2011).

The sample size ($n = 316$) was acceptable based on the KMO measure (0.782) and Bartlett's test of sphericity ($\chi^2 = 543.91$, df = 10, $p < .001$). Principal component analysis revealed a single factor (eigenvalue = 2.91) which accounted for 58.14% of the variance. Inspection of the scree plot confirmed this pattern. Cronbach's alpha coefficient was .82, and correlations of items with the average score ranged from .73 - .79.

Table 2.2.

A principal analysis and pattern matrix of the simplified Chinese version of the Friend Support for Exercise Habits Scale

Item number	Item abbreviations	M	SD	Factor I
1	Exercised with me	2.11	1.06	.66
2	Offered to exercise with me	1.97	.96	.71
3	Gave me helpful reminders…	1.87	1.04	.63
4	Gave me encouragement…	1.89	1.09	.73
5	Changed their schedule so we could exercise together	1.62	.89	.73

Note. Items were rated on a scale from 1- 5.

2.4.3. Self-Construal Scale

Self-construal was measured using a questionnaire developed by Park and Kitayama (2012) from Singelis' (1994) and Takatas' (Takata, 1999) self-construal scales. Two subscales, independent (items 1-10) and interdependent (items 11-20), are proposed for the structure of the questionnaire; however, the factor structure has not been previously examined. Participants rate their agreement with each statement on a 7-point scale from 1 (strongly disagree) to 7 (strongly agree). An example question from the interdependent subscale is, "I am concerned about what people think of me". The independent subscale includes items such as, "I always try to have my own opinions". The scale yielded scores for interdependent and independent self-construal and has shown internal consistencies of $\alpha = .66$ and $\alpha = .78$, respectively for a sample of Japanese, Asian Canadians, and European Canadians (Ito, 2014).

Due to low correlations, varimax rotation was used for this analysis. Initial extraction revealed 5 factors meeting the criteria of eigenvalues >1, however, inspection of the scree plot revealed ambiguity between factors 3-5. Based on the scree plot and the hypothesized structure, the analysis was continued with a forced extraction of 2 factors. The sample ($n = 318$) had a KMO statistic of 0.818 and Bartlett's test of sphericity ($\chi^2 = 1627.36$, df = 171, $p < .001$) was acceptable. After rotation, item 2 loaded on both factors with low values (.38, .45), and was

removed from the next analysis. After removing item 2, items 15 and 18 had very low factor loadings (.34, and .38 respectively), and low average scores. The items were also removed. Finally, item 17 showed a low factor loading (.34) and was removed from the final analysis. Consultation with one of the bilingual translators revealed support for the removal of these items as they may not be reflective of the population of interest. Specifically, these items may be more reflective of self-construals of older Chinese people rather than the younger generation in this sample whose interdependent beliefs may not be as strong (Walker, Jackson, & Deng, 2008). The final two factors were independent (eigenvalue = 4.10, α = .83) which accounted for 25.6% of the variance, and interdependent (eigenvalue = 2.78, α = .72) which accounted for 17.3% of the variance.

Table 2.3.

A principal analysis with varimax rotation and pattern matrix of the simplified Chinese version of the Self-Construal Scale

Item number	Items	M	SD	Factor I	Factor II
1	I always try to have my own opinions	3.95	.84	.67	
2	I am comfortable with being singled out for praise or rewards	3.81	.99		
3	The best decisions for me are the ones I made by myself	3.69	.92	.62	
4	In general I make my own decisions	3.94	.86	.64	
5	I act the same way no matter who I am with	2.90	.97	.55	
6	I am not concerned if my ideas or behaviour are different from those of other people	3.19	1.05	.63	
7	I always express my opinions clearly	3.38	.90	.56	
8	Being able to take care of myself is a primary concern for me	3.58	.91	.53	
9	I enjoy being unique and different from others in many respects	3.45	1.01	.53	
10	I do my own thing, regardless of what others think	2.99	.95	.61	
11	I am concerned about what people think of me	3.40	1.00		.41
12	In my own personal relationships I am concerned about the other person's status compared to me	3.68	.92		.42

	and the nature of our relationship			
13	I think it is important to keep good relations among one's acquaintances	4.21	.76	.70
14	I avoid having conflicts with members of my group	4.19	.76	.65
15	When my opinion is in conflict with that of another person's, I often accept the other opinion	2.95	.84	
16	I respect people who are modest about themselves	4.43	.69	.48
17	I will sacrifice my self-interest for the benefit of the group I am in	3.42	.88	
18	I often have the feeling that my relationships with others are more important than my own accomplishment	2.95	.97	
19	I feel my fate is intertwined with the fate of those around me	3.72	.95	.45
20	Depending on the situation and the people that are present, I will sometimes change my attitude to behaviour	3.94	.73	.68

Note. Items were rated on a scale from 1-7. Darkened items were removed during analyses.

2.4.4. Perceived Stress Scale

The Perceived Stress Scale (PSS) includes 10 items measuring the frequency of thoughts or feelings in the past month on a scale from 1 (never) to 4 (very often). For example, one negative perception question asks, "In the last week, how often have you been upset because of something that happened unexpectedly?" A positive item reads, "In the last week, how often have you felt that you were on top of things?" The original version (S. Cohen et al., 1983) suggested a two factor structure (positive and negative life events) which has been supported in several populations (E.-H. Lee, 2012). The PSS- Chinese was previously translated by Wang et al. (2011).

The sample size (n = 323) was found to be acceptable using the KMO statistic (0.820) and Bartlett's test of sphericity (χ^2 = 854.05, df = 45, p < .001). Two factors had eigenvalues greater than 1. The first factor, negative items (eigenvalue = 3.58, α = .82), explained 35.83% of

the variance. The second factor, positive items (eigenvalue = 1.66, α = .67), explained 16.60% of the variance.

Table 2.4.

A principal analysis with oblimin rotation and pattern matrix of the simplified Chinese version of the Perceived Stress Scale

Item number	Item abbreviations	M	SD	Factor I	Factor II
1	… upset because of something that happened unexpectedly?	3.15	.75	.68	
2	…unable to control the important things in your life?	3.13	.86	.76	
3	…felt nervous and "stressed"?	2.70	.99	.67	
6	…found that you could not cope with all the things that you had to do?	3.09	.86	.64	
9	…been angered because of things that were outside of your control?	2.67	.92	.64	
10	…felt difficulties were piling up so high that you could not overcome them?	2.79	1.02	.67	
4	…felt confident about your ability to handle your personal problems?	2.61	.81		.62
5	…felt that things were going your way?	2.62	.75		.57
7	…been able to control irritations in your life?	2.21	.86		.48
8	…felt that you were on top of things?	2.62	.75		.67

Note. Items are rated from 1-5. Items use the stem "In the last month, how often have you…" Positive items were reverse scored.

2.4.5. Satisfaction with Life Scale

The original Satisfaction with Life Scale (SWLS) has five items assessing overall life satisfaction measured on a 7-point scale (1 [strongly disagree] to 7 [strongly agree]). For example, one item states, "In most ways my life is close to my ideal". In a sample of Hong Kong university students, the single-factor model was supported, with a reliability of α = .82 (Sachs, 2003). The single factor model has been supported in the Chinese version of the scale that was previously translated (Sachs, 2003; C. Wu & Yao, 2006).

The sample of 323 was suitable for analysis using the KMO statistic (0.846) and Bartlett's test of sphericity ($\chi^2 = 934.63$, df = 10, $p < .001$). One factor was extracted in the first

analysis (eigenvalue = 3.39) which explained 67.81% of the variance. Item five "If I could live my life over, I would change almost nothing" had a much lower average score, lower factor loadings, small correlations with the other items, and would improve reliability of the scale upon removal. These reasons in addition to the fact that this item may be inappropriate for young students lead to the deletion of this item from the scale. The resulting analysis showed one factor (eigenvalue = 3.06) that explained 76.58% of the variance. The reliability of the scale was α = .89.

Table 2.5.

A principal analysis and pattern matrix of the simplified Chinese version of the Satisfaction with Life Scale

Item number	Items	M	SD	Factor I
1	In most ways my life is close to my ideal.	4.82	1.25	.92
2	The conditions of my life are excellent	4.52	1.23	.90
3	I am satisfied with my life	4.72	1.33	.80
4	So far I have gotten the important things I want in life	4.43	1.43	.70
5	If I could live my life over, I would change almost nothing	3.46	1.65	

Note. Items were rated on a scale from 1- 5. Darkened item was removed during analyses.

2.4.6. Affect Valuation Index

The actual affect scale of the Affect Valuation Index (AVI) was previously translated into simplified Chinese (J. L. Tsai et al., 2006). It measures frequency of certain affective states over the past week from 1 (never) to 5 (all the time). The items were sampled from the affective circumplex (Watson & Tellegen, 1985; Yik & Russell, 2003) which includes eight emotion 'octants': high-arousal positive (e.g., enthusiastic), positive (e.g., happy), low-arousal positive (e.g., calm), low-arousal (e.g., quiet), low-arousal negative (e.g., dull), negative (e.g., sad), high-arousal negative (e.g., fearful), and high-arousal (e.g., surprised). Previous research that used an experience sampling method used a sample of seven positive and negative items from the scale

in order to reduce participant burden (Sims et al., 2015). The present study included only frequency of positive and negative affect states to measure subjective well-being in conjunction with the SWLS. Therefore, only 20 items were included in the factor analysis (excluding the high arousal and low arousal items). In addition, 13 items included in the Chinese version of the scale (39 items total) were not categorized into any of the octants by the original authors of the Chinese version of the scale, or in previous research, and were not included in this analysis. Please see the Appendix D for a list of all the items, and their Chinese translations.

Three factors were extracted using eigenvalues greater than one. The items (23, 29, 30) represented items in the "low arousal positive" octant, and were "calm", "serene", and "peaceful". These items had low correlations with the other items and appeared to cross load onto other factors. These are categorized in the 'low arousal positive' dimension, and the means indicated that they represented a large portion of the affect in the sample. Previous research suggested a preference for low arousal positive affect in Chinese samples (J. L. Tsai, 2007), therefore the items were retained in order to capture relevant affective states for Chinese international students. In the final analysis, the sample of 310 was acceptable using the KMO statistic (.851) and Bartlett's test of sphericity ($\chi^2 = 2559.09$, df = 190, $p < .001$). Factor 1, positive affect (eigenvalue = 5.27, $\alpha = .87$) explained 26.33% of the variance. The second factor, negative affect (eigenvalue = 3.78, $\alpha = .83$) explained 18.87% of the variance. The third factor, low arousal positive affect, (eigenvalue = 1.70, $\alpha = .79$) explained 8.5% of the variance.

Table 2.6.

A principal analysis with oblimin rotation and pattern matrix of the simplified Chinese version of the Affect Valuation Index.

Item Number	Item name	M	SD	Factor I	Factor II	Factor III
9	Elated	2.69	.85	.77		
21	Happy	3.27	.78	.75		.42
15	Content	3.05	.83	.72		.32
7	Excited	2.70	.81	.68		
27	satisfied	3.15	.87	.67		.48
19	Euphoric	2.06	.79	.60		
1	Enthusiastic	3.32	.89	.58		
6	Relaxed	3.08	.85	.53		.38
18	Sad	2.15	.80		.71	
24	Unhappy	2.36	.73		.71	
26	Hostile	1.89	.82		.65	
20	Fearful	1.88	.80		.64	
16	Sluggish	2.52	.92		.57	
12	Lonely	2.66	.98		.56	
4	Dull	2.47	.84		.54	
10	Sleepy	2.83	.85		.53	
3	Nervous	2.5	.81		.49	
30	serene	3.42	.82			.93
29	Peaceful	3.45	.81	.31		.85
23	calm	3.35	.81			.48

Note. Items were rated on a scale from 1- 5

2.5. Test-Retest Results

2.5.1. Participants

The sample for the test-retest ($N = 21$) was 57.1% female, and all the participants completed both time points. There were five first year students, eight second year, four third year, and four students in their fourth year of study. The average age was 20.43 ± 1.08 years.

2.5.2. Data analysis

Interpretation of the intraclass correlation coefficient (ICC) estimates was based on Koo and Li (2016). Specifically, < 0.5, 0.5- 0.75, 0.75-0.9, and > 0.9 indicate poor, moderate, good, and excellent reliability, respectively. Selecting and interpreting ICCs was done based on mean

ratings of the subscales at each time point, absolute agreement, and two-way mixed effects model. Table 2.7 displays the results of the test-retest.

Table 2.7.

Intraclass Correlation Coefficient estimates for the subscales included in the reliability analyses

	Test M (SD)	Retest M (SD)	ICC	95% Confidence Interval		Interpretation
				Lower Bound	Upper Bound	
IPAQ						
Walking	1112.57 (1018.99)	623.01 (392.37)	.340	-.380	.711	Poor - moderate
MPA	784.76 (647.89)	730.48 (647.89)	.266	-.900	.708	Poor - moderate
VPA	780.00 (999.83)	1155.79 (1359.40)	.746	.344	.904	Poor - good
MSES	48.87 (22.68)	51.91 (22.89)	.752	.390	.900	Poor - good
Friend Support	2.15 (0.98)	2.13 (0.96)	.866	.666	.946	Good - excellent
Self-Construal	3.48 (0.36)	3.45 (0.37)	.814	.509	.929	Moderate - excellent
Interdependent	4.12 (0.45)	4.01 (0.49)	.804	.508	.922	Moderate - excellent
Independent	2.98 (0.65)	3.08 (0.67)	.897	.744	.959	Moderate - excellent
Perceived Stress Scale	3.29 (0.38)	3.18 (0.44)	.339	-.613	.731	Poor - good
Positive	3.25 (0.49)	3.54 (0.56)	.382	-.344	.735	Poor - good
Negative	3.32 (0.65)	2.93 (0.62)	.528	-.058	.800	Poor - good
SWLS	4.08 (1.25)	4.69 (1.13)	.646	.159	.854	Poor - good
AVI	2.72 (0.32)	2.72 (0.54)	.436	-.450	.775	Poor - good
Positive	2.91 (0.62)	2.99 (0.79)	.695	.241	.877	Poor - good
Low Arousal Positive	3.21 (0.76)	3.19 (0.86)	.551	-.143	.820	Poor - good
Negative	2.37 (0.50)	2.33 (0.67)	.553	-.124	.820	Poor - good

Note. $N = 21$. IPAQ = International Physical Activity Questionnaire; MSES = Multidimensional Self-Efficacy for Exercise Scale; SWLS = Satisfaction with Life Scale; AVI = Affect Valuation Index; ICC = Intraclass Correlation Coefficient

Interpretation based on < 0.5 (poor), 0.5- 0.75 (moderate), 0.75-0.9 (good), and > 0.9 (excellent)

2.6. Test-Retest Discussion

The results of the test-retest appear to indicate that several of the measures are not reliable over time. It has been noted, however, that several factors can influence how a measure performs over time including learning effects, problems with item comprehension, lack of attention or careless responding, and the state dependent nature of some measures (e.g., mood; Ingram & Ternes, 2018). Some of these reasons may have occurred in the present analyses. For example, in their examination of life satisfaction measures, current mood accounted for at least part of the variance in the measure despite the nature of the scale which is to assess chronically accessible information (Diener, Inglehart, & Tay, 2013). Variations in stress and affect may be due to the instability of these constructs and their potential to change over even just one week due to contextual factors. Self-construal could be considered a trait-like measure which did show reliability over time in this analysis. This measure may rely less on emotion or affect when determining responses.

Differences in physical activity behaviour and self-efficacy for exercise were unexpected. Researchers have suggested that people may find it easier to recall more structured activities such as sports or recreational walking (Brown, Trost, Bauman, Mummery, & Owen, 2004). This may have also been true in our study because the description for walking was not specific to transportation or leisure, and moderate physical activity includes unstructured activities such as gardening or housework. Reliability in a large sample of older Chinese adults using the IPAQ-C showed ICCs of 0.81-0.89 (Deng et al., 2008). It is possible the students in the current sample had large variation in their physical activity behaviour from week to week, or the sample was not large enough to offer valid statistics, especially as the sample size was close to the minimum required to perform these analyses (Banville et al., 2000).

It follows that self-efficacy for physical activity may fluctuate along with the behaviour because people may rely on their past behaviour to generate beliefs about future behaviour (Bandura, 1997; Rodgers et al., 2008). One would rely on their environmental context, personality, and behaviour to estimate self-efficacy for physical activity. Although personality is a stable trait, the environment may be prone to change with social obligations, schoolwork, and weather fluctuations the students may experience. Simply completing a measure on physical activity and self-efficacy may cause behavioural and cognitive changes and these may have been reflected in the results.

Overall, the long survey, and small sample size may have contributed to more error in the test-retest analysis than is acceptable. Because of this influence of sample characteristics, the test-retest is known for its higher error rates compared to other reliability estimates (Ingram & Ternes, 2018). The reliability coefficients may be a better indicator of the performance of each measure, and these were acceptable for the adjusted measures carried forward into the remaining analyses.

Attention to semantic meaning and context was taken into great consideration throughout the translation process, adding to the validity of the questionnaires used for this research. In the EFA, adequate structures and items were determined for each measure, and factorial validity and reliability were established. Items were retained based on their statistical and cultural relevance. Although the test-retest results were highly varied, taken together with the other measures of validity and reliability, we are confident that the measures carried forward in this project are adequate and accurately portray the concepts targeted in this research.

2.7. Study One, Part II: Social cognitive determinants of moderate and vigorous intensity leisure time physical activity in mainland Chinese university students

2.7.1. Introduction

The World Health Organization (WHO) supports regular moderate intensity physical activity for important health benefits such as reducing risk for cardiovascular disease, diabetes, breast cancer, and depression (World Health Organization, 2017). Beyond health, physical activity has been linked with improved academic performance for students (Booth et al., 2014; Rasberry et al., 2017). In a sample of universities in 23 countries, 41.4% of undergraduate students were physically inactive, and China had a particularly high rate of physical inactivity at 45.8% (Pengpid et al., 2015). This physical inactivity could contribute to poor mental health for university students (VanKim & Nelson, 2013). For Chinese university students specifically, moderate to high depression is prevalent (L. Chen et al., 2013; Lei et al., 2016) with low physical activity and high screen time potentially contributing to their poor mental health (X. Wu et al., 2015). In light of these findings, engaging in physical activity may aid in improving mental health for Chinese university students (Y. Wang et al., 2004).

Variables such as age, health status, self-efficacy, and one's social and physical environment are a few examples of correlates of physical activity behaviour (Bauman et al., 2012). Some of these variables can be targeted in the development of physical activity interventions for university students; however, they should be understood within the targeted cultural context (Nigg, Jake-Schoffman, & Janke, 2017). Social cognitive theory (SCT; Bandura, 1986) has been touted as a versatile theory in explaining physical activity because of SCT's emphasis on the interactions of behaviour, personal, and environmental factors (Bandura, 1986a). Young and colleagues (2014) found that 31% of the variance in physical activity was

accounted for by SCT using a random-effect meta-analysis, and concluded that SCT was a useful framework to explain physical activity. Importantly, only one study included in the meta-analysis was conducted in China (Murnan, Sharma, & Lin, 2006). Examining the SCT variables applicable to a Chinese university student population is, therefore, a logical first step in understanding physical activity motivation in this group.

The emphasis of SCT on context makes it especially appropriate to use in a variety of cultural settings. An important personal and cultural component often considered in cultural psychology is self-construal (i.e., a person's perception of themselves in relation to others around them), which can influence behaviour, emotion, cognition, and motivation among other psychological processes (Markus & Kitayama, 1991). Two overarching self-construals have been proposed: independent and interdependent. Independent self-construals are generally reflected in Western cultural contexts (e.g., Canada, United States of America) and they emphasize the distinction and separateness of people. People with independent self-construals primarily use their own thoughts and emotions to organize and provide meaning to their behaviour. Those with interdependent self-construals tend to reference the feelings, thoughts, and behaviours of others, and this type of self-construal is common in Eastern cultural contexts such as China or Japan. Interdependent people view themselves as a part of larger social relationships such that people are connected to one another, and the needs and goals of significant others are important to maintain. While certain cultures show patterns reflecting one type of self-construal, every culture encompasses some aspects of both types (Markus & Kitayama, 1991).

The proposed model explaining the effects of SCT variables on LTPA (Figure 2.1) depicts the roles of personal and perceived environmental factors on physical activity as described by Bandura (1986). A central component influencing behaviour in SCT is self-

efficacy, a person's belief that he or she can successfully carry out a given course of action. Personal efficacy is imperative to the accomplishment of goals regardless of self-concept (which can be culturally shaped) and the structural and functional properties of self-efficacy have shown cross-cultural congruency (Bandura, 2002). Researchers have identified three types of self-efficacy for exercise behaviour: task (e.g., can I do the required behaviour?), scheduling (e.g., can I add this behaviour into my routine?) and coping (e.g., can I do this behaviour despite barriers?) (Bandura, 1997; Rodgers et al., 2008; Rovniak et al., 2002). Self-efficacy can directly influence behaviour or work indirectly through other SCT variables, such as sociostructural factors (barriers or facilitators to behaviour), self-regulation, and outcome expectations (Bandura, 1997, 2004). Outcome expectations have shown inconsistent relationships with physical activity (Anderson et al., 2006; Ayotte et al., 2010; Doerksen et al., 2009; Young et al., 2014) and there has been debate about its role in predicting behaviour in addition to and in combination with self-efficacy (D. M. Williams, 2010; D. M. Williams, Anderson, & Winett, 2005). Direct effects of outcome expectations were not supported in Young and colleague's (2014) meta-analysis, possibly due to the construct being moderated by characteristics such as age (i.e., greater effect with higher age). Because of the possibly confounding nature of the construct, outcome expectations were not included in the present model.

Higher self-efficacy can contribute to intentions; those who feel they are physically competent, can overcome barriers to participation, and can complete the behaviour consistently will likely have better intentions, or set goals to complete the behaviour (Bandura, 2004). Intention to be physically active is associated with self-regulation and goal setting which have shown consistent relationships with physical activity (Bandura, 2004; Rhodes & Quinlan, 2015). In the current analyses, intention was used as an indicator of self-regulation.

In addition to intention, opportunities to be physically active are an important sociostructural factor that can directly or indirectly impact physical activity (M. Booth, 2000; Carlson et al., 2012). Self-efficacy is proposed to be related to sociostructural barriers; if a person has low self-efficacy, they are not likely to persevere in the face of perceived barriers (e.g., few places to be physically active; Bandura, 2004). For example, Carlson and colleagues (2012) found that older adults with supportive environments such as better neighborhood walkability and more positive psychosocial attributes (i.e., self-efficacy, social support) were more active compared to those with less positive psychosocial attributes. Bandura (1998, 2004) proposed that sociostructural factors can influence proximal goals (i.e., intentions) related to health behaviour. For example, if one does not perceive that there are places to play tennis, they will not set a proximal goal to play two times this week.

Social support is a personal and environmental variable included in SCT and it has been shown to improve physical activity adherence through self-regulation and self-efficacy (Anderson et al., 2006; Ayotte et al., 2010). For Chinese university students, social support may be extremely relevant due to the importance of social relationships on behaviour and cognition in interdependent cultures (Markus & Kitayama, 1991). Research by Taylor et al. (2004) found that Asian/Asian American students (interdependent) were less likely to seek out social support to cope with stress compared to their European American counterparts (independent). In addition, Asian Americans (second generation) sought more help from their families for support during times of stress compared to Asian nationals and immigrants which may indicate an effect of acculturation into the more independent American culture. Concerns about disturbing group harmony, causing loss of face, being criticized, or exacerbating the situation were identified as reasons Asians/Asian Americans might avoid seeking social support (S. E. Taylor et al., 2004).

Markus and colleagues (1997) suggest that those who endorse interdependence may have more to lose socially from seeking help from others than they have to gain from their support, and thus will avoid burdening important relationships.

Social support has not shown direct relationships with physical activity in previous research (Anderson et al., 2006), or it has been excluded in models examining SCT and physical activity (Young et al., 2014). In order to examine the role of social support in a Chinese context, we tested an alternative model in which social support directly related to vigorous physical activity, as this behaviour may require more support compared to moderate physical activity.

In one of the few studies examining the SCT framework to physical activity in an East Asian culture, with Chinese adolescents, self-efficacy moderated the mediation relationship between intentions to be physically active, planning (mediator), and physical activity (Luszczynska et al., 2010), a finding that exemplifies the dynamic role of self-efficacy in a Chinese sample that is in line with the theoretical assumptions of SCT (Bandura, 1997). In another example, Sriramatr and colleagues (2014) conducted an internet-based intervention with female students in Thailand. In the intervention group, increases in physical activity, self-efficacy, self-regulation, and outcome expectations were greater compared to the control group and were maintained at 6-month follow-up. The authors suggested that the SCT variables, which are focused on the social nature of humans, may exhibit stronger psychological relationships with the interdependent Thai students than the more independent Western students.

The present study

The present research used structural equation modelling to examine the direct, indirect, and total effects of SCT constructs on leisure time physical activity (LTPA) in mainland Chinese university students based on Bandura's SCT model of health behaviour (Bandura, 2004).

Applying SCT to physical activity among Chinese university students is important for developing and understanding SCT constructs in a Chinese setting. Furthermore, identifying mechanisms responsible for participation in physical activity in this population may inform intervention efforts with far-reaching benefits, from reduced depression to better physical health (World Health Organization, 2017). Specifically, we tested the direct effects of self-efficacy on LTPA (vigorous and moderate intensity), and the indirect effects of self-efficacy on behaviour through intentions to be physically active, and perceived access to places to be physically active on and off the university campus (sociostructural factor). Access was tested as an indirect predictor of vigorous and moderate physical activity through intentions. Intentions were examined as direct predictors of LTPA. An indirect relationship between social support from friends and LTPA was examined through self-efficacy (see Figure 2.1). An alternative model that included a direct path between social support and vigorous LTPA was also tested (dashed line Figure 2.1).

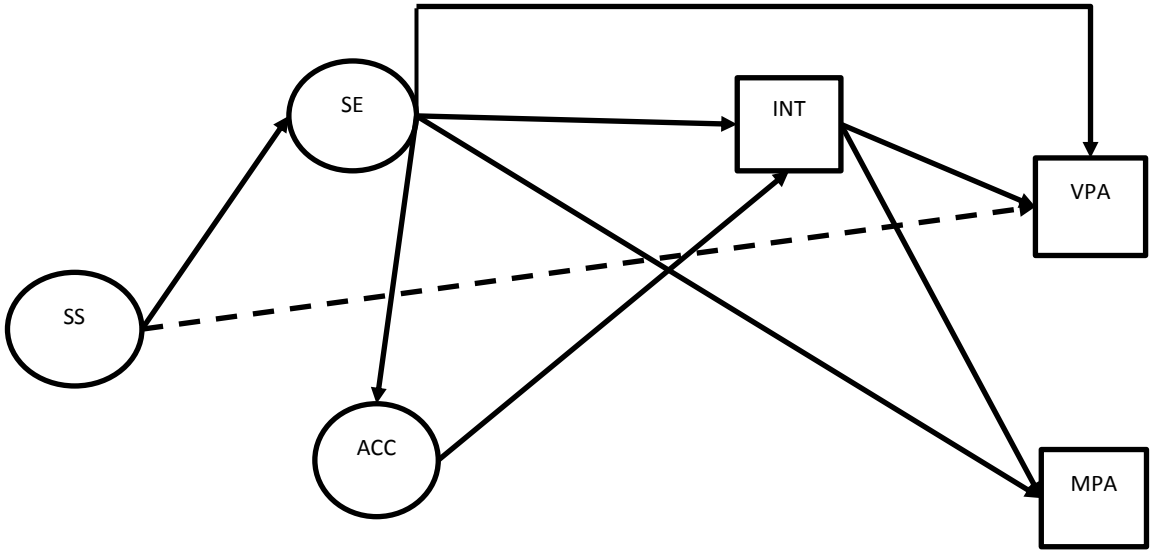

Figure 2.1. Conceptual structural equation model for mainland Chinese university students (N = 317). Sex, BMI, age and year of study are included as control variables. VPA = Vigorous intensity leisure time physical activity; MPA = moderate intensity leisure time physical activity; SS = social support; SE = self-efficacy; INT = intention to be physically active; ACC = perceived access to physical activity opportunities. Dashed line indicates alternative model. Circles represent latent variables, squares represent single indicator variables.

2.7.2. Method

Procedures

The same sample of Chinese students was used as in the previous section (see 2.2.).

Participants

A total of 327 students completed the survey. Students who indicated they were not undergraduates (i.e., Master's students, graduate students; $n = 6$) and students who took less than 200 seconds to complete the survey ($n = 4$) were removed from the analysis. This cut-off was selected as an indicator of careless responding by these participants, combined with inspection of the data (e.g., all the same number for each survey item on a page; Meade & Craig, 2012). The participants had a mean age of 20.16 years (SD =1.57), and 54.8% identified as female. Most participants were first year students (41.9%) compared to second (24.7%), third (20.5%), and fourth year (13.0%). Participants studied a range of disciplines, many from engineering (24.5%), humanities and social sciences (14.9%), medicine (10.2%), math or finance (11.5%), and science (13.0%). The mean body mass index (BMI) was 20.60 (SD = 2.41) which is within the "normal" range for Asian adults (Chinese Community Health Resource Center, 2017). Participants reported an average of 1.96 (SD = 1.84) days per week of VPA, and 3.98 (SD = 2.52) days per week of MPA.

Measures

The measures included in this study were self-efficacy, intention, access perceptions, social support, self-construal, leisure time physical activity, age, sex, and BMI. Please see the Measures section (1.9.) for descriptions of each questionnaire. The following descriptions indicate how each questionnaire was treated in the structural equation modelling procedures.

Self-efficacy. This EFA revealed a single factor explaining 67.5% of the variance; however, to remain consistent with theory, three subscales were used to estimate self-efficacy in the model.

Social support. The five items were parcelled into three indicators for the structural model using by combining items with higher correlations to the latent construct of social support and those with smaller correlations (items 4 and 1, and items 2 and 3 were averaged and item 5 was used as an indicator).

Accessibility. Two items acted as indicators for the latent factor.

Intention. This single item measure was used as a single indicator in the model.

Self-construal. Average scores of the independent and interdependent subscales were compared within the sample.

Leisure time physical activity. VPA and MPA scores were calculated in METs and used as single indicators for the analyses.

Control variables. Age, year of study, BMI, and sex were included as covariates in the model.

Data preparation and analysis

Univariate ANOVAs and chi-square tests were used to explore the data, and differences were found for age, body mass index (BMI), sex, and study year on some variables included in the model ($ps < .05$). Specifically, first year students had higher scores on interdependent self-construal compared to third or fourth year students. Younger students (17-22 years) had higher ratings of intention to be physically active and perceived access to places to be active, and did more MPA compared to older students (23-28 years). Males had higher scores on VPA, self-efficacy, intention, and access perceptions compared to females.

MPlus version 7.2 was used to conduct further analyses (Muthén & Muthén, 1998-2012). The data set ($N = 315$) had less than 3% missing data, which were handled using full information maximum likelihood estimation (FIML). Data were examined for multivariate normality and outliers. One outlier case with extreme scores on all variables was removed (Mahalanobis distance, df = 14, $p < .001$). Two participants with extreme scores on VPA and MPA were removed from the analyses. Both MPA and VPA scores were non-normally distributed, due to the large number of people who responded with zero days of physical activity. As a result, the MLR estimator was used for the analyses, and the adjusted model fit values and coefficients are presented.

Bivariate correlations were first computed for variables included in the analysis (see Table 2.8). Self-construal means were examined using a *t*-test to determine if the Chinese students rated themselves higher on independent or interdependent self-construal. Self-construal was not included in the model for three reasons: (a) the purpose of the study was to examine SCT in a Chinese context, (b) the bivariate correlations indicated small correlations between self-construal and SCT variables, and (c) the model would not converge with self-construal included as a moderating variable between social support and self-efficacy. Confirmatory factor analysis was used to examine factor structure. The structural model was then constructed. Overall model fit statistics calculated were the chi-square test (χ^2), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the standardized root mean square residual (SRMR). Good fit to the data is indicated by a nonsignificant chi-square test, RMSEA and SRMR less than .05, and CFI > .90 (Little, 2013). Improvements in model fit after making adjustments were tested using the chi-square difference test or Satorra-Bentler scaled chi-square difference test. Local model fit was evaluated by inspecting normalized residuals. Indirect effects

were tested using bootstrapped estimates (n = 5000). The model was tested for differences by sex, but no differences were found.

2.7.3. Results

Correlations and preliminary analysis

The bivariate correlations (Table 2.8) showed small to moderate associations between VPA and MPA and most of the SCT variables (J. Cohen, 1988). Self-efficacy, intention, social support, and access had similar associations, except for access and social support which had a very small correlation. As expected, a very small correlation was found between moderate intensity LTPA and social support. Being male was associated with higher self-efficacy, intention, and both LTPA intensities, but sex was not associated with social support or access. In this sample, 73% of participants reported meeting "high active" criteria outlined by Bauman and colleagues (2009) as well as in the IPAQ scoring manual (i.e., 1500-3000 METs per week). Moderately active was indicated by scoring over 600 METs per week, and 19.5% of the sample reported between 600 and 1500 METs per week. The rate in our sample for those who were high active is slightly higher than the prevalence of 57.7% found in the Chinese adult population, but the moderately active group was lower than the Chinese population average of 35.4%. Our sample had 5.2% in the low active group which was comparable to 6.9% in the low active group in the Chinese adult population sample (0-600 METs per week; Bauman et al., 2009).

Only independent self-construal showed associations with self-efficacy, intention to be physically active, social support, and access perceptions. The latter two relationships were statistically significant, but relatively small. Interdependent self-construal shared small correlations with only moderate LTPA. As expected, participants within the sample rated

themselves higher on measures of interdependent self-construal ($M = 3.92 \pm 0.53$) compared to independent self-construal ($M = 3.44 \pm 0.61$; t (312) = 16.32, $p < .000$).

Measurement model

The initial measurement model did not yield acceptable fit to the data, χ^2 (34) = 87.63, $p < .001$); RMSEA = .07, SRMR = .06, CFI = .95. Inspection of modification indices and normalized residuals resulted in the addition of several covariances between variables that are conceptually linked to one another in this population. Specifically, task self-efficacy residuals were allowed to covary with scheduling self-efficacy residuals and intention residuals. The coping self-efficacy residuals were allowed to covary with residuals of access perceptions within the university, and intention. The scheduling subscale of self-efficacy residuals were allowed to covary with the residuals of social support items two and three. Social support (latent) residuals were allowed to covary with university access perception residuals. These changes resulted in a much better fit to the data (χ^2 (27) = 35.128, $p = .135$; RMSEA = .03, 90% CI [.00 - .05], SRMR = .03, CFI = .99) that was significantly improved from the initial CFA model, (χ^2_{diff} (7) = 55.18, $p < .001$).

Structural model and alternative model

The initial structural regression model yielded a good fit to the data, χ^2 (46) = 53.21, $p = .22$; RMSEA = .02, 90% CI [.00 - .05], SRMR = .04, CFI = .99. Examination of the residual data and modification indices revealed additional support for testing the alternative model (regressing VPA on social support). The alternative model improved model fit to the data, TRd(1) = 11.12, $p < .001$ (see Figure 2.2 for model fit statistics; Supplement 1 (Table 2.9) contains all standardized and unstandardized coefficients; Supplement 2 (Table 2.10) shows the estimated covariance matrix). Interestingly, the relationship between self-efficacy and VPA was significant ($\beta = 0.32$,

$p < .001$) prior to the addition of the path between social support and VPA. The indirect path between social support and VPA through self-efficacy was also significant in the first model. After the direct path between social support and VPA was added, the link between self-efficacy and VPA was no longer significant ($\beta = 0.14$, $p = .21$). The alternative model was retained as the final model.

In the final model, social support for exercise was significantly related to self-efficacy for exercise and VPA. Self-efficacy was also significantly related to intention to be physically active and perceptions of places to be physically active (access). The relationships between self-efficacy, and intention to both types of physical activity were nonsignificant. Given that there were no significant pathways linking social support indirectly to LTPA, tests of indirect effects were not necessary.

Table 2.8.

Bivariate correlations and descriptive statistics study one part II

Variables	Mean (*SD*)	Range	1	2	3	4	5	6	7	8	9	10	11	12
1. VPA	864.76 (1250.71)	0-7680	1											
2. MPA	913.24 (983.62)	0-5040	.16[a]	1										
3. Self-efficacy	55.83 (22.42)	0-100	.35[b]	.19[a]	1									
4. Intention	4.88 (1.81)	1-7	.40[a]	.27[a]	.65[a]	1								
5. Social Support	1.92 (0.80)	1-5	.16[a]	.00	.32[a]	.23[b]	1							
6. Access	4.50 (1.32)	1-7	.18[a]	.15[b]	.30[a]	.33[a]	.03	1						
7. Ind. self-construal	3.44 (0.61)	1-7	.02	.03	.29[a]	.23[a]	.12[a]	.16[a]	1					
8. Inter. self-construal	3.92 (0.53)	1-7	.01	.12[b]	-.00	.11	-.08	.07	-.07	1				
9. Age	20.16 (1.57)	17-28	-.13[b]	-.19[a]	-.12[b]	-.15[a]	.09	.06	.08	-.15[b]	1			
10. Sex	1.55 (0.49)	1-2	-.26[a]	-.12[b]	-.27[a]	-.24[a]	.03	-.08	.02	.00	.03	1		
11. BMI	20.60 (2.41)	15.60-30.45	.033	.00	.15[a]	.17[a]	.03	.02	.04	-.23	-.01	-.29[a]	1	
12. Study year	2.05 (1.07)	1-4	-.11	-.17[a]	-.03	-.09	.15[b]	12[b]	.14[b]	-.19[a]	.72[a]	.08	.07	1

Note. LTPA = leisure time physical activity; Ind. = independent; Inter. = interdependent; BMI= body mass index; Male = 1, female = 2; SD = standard deviation.

[a] $p < .001$; [b] $p < .01$.

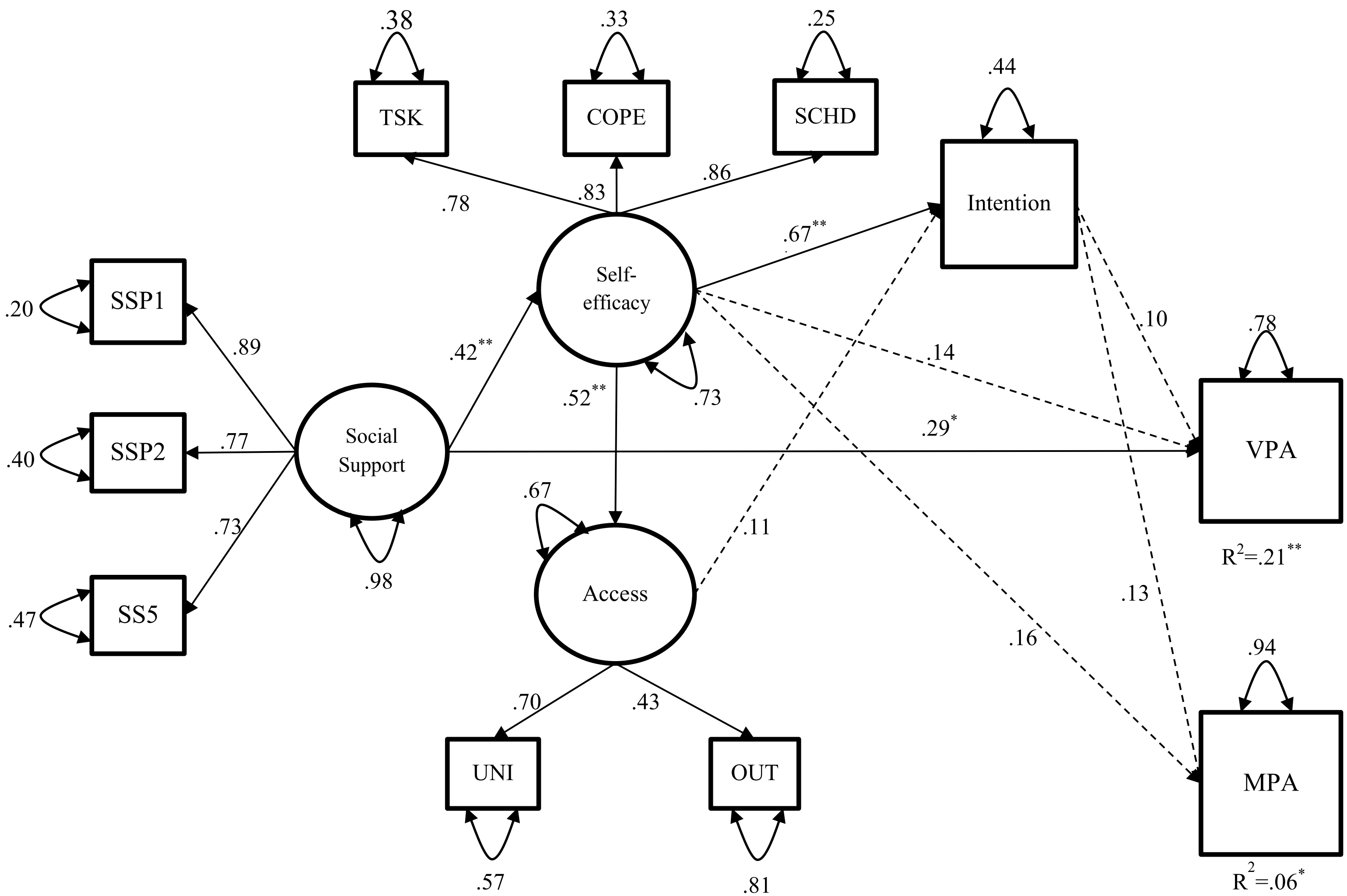
.38
.33
.25
.44
TSK
COPE
SCHD
Intention
.78
.83
.86
.67**
SSP1
SSP2
SS5
.20
.40
.47
.89
.77
.73
Social
Support
.98
.42**
Self-
efficacy
.73
.52**
.10
.78
.14
.29*
VPA
R²=.21**
.67
Access
.11
.13
.16
.94
MPA
R²=.06*
.70
.43
UNI
OUT
.57
.81

Figure 2.2. Accepted structural equation model for mainland Chinese university students. Standardized estimates reported. N = 308. Age, sex and body mass index (BMI) included as covariates (not shown). SSP1/2= social support parcel 1/2; TASK= task self-efficacy, COPE = coping self-efficacy, SCHD = scheduling self-efficacy; Access= perceived access to places to be physically active; Intention = intention to be physically active; UNI/ OUT = perception of access to places to be active in the university or outside the university; LTPA = leisure time physical activity. Dashed lines indicate non-significant pathways. $\chi 2$ (45) = 36.49 (p = .813), RMSEA = .00, 90% CI [.00 - .03], SRMR = .03, CFI =1.00.
$^{**}p < .001$, $^{*}p < .05$.

2.7.4. Discussion

This study examined SCT variables and their effects on MPA and VPA in a sample of Chinese undergraduate students. Social support was positively related to self-efficacy, and was the only variable that directly influenced VPA. More self-efficacy was related to higher intentions to be physically active and higher perceptions that one could access places to be physically active.

Self-efficacy, and self-regulatory behaviour have demonstrated strong relationships with physical activity in past research conducted with Western samples (Anderson et al., 2006; Ayotte et al., 2010; Rovniak et al., 2002). In our sample, students who had more self-efficacy had higher intentions to be physically active, and perceived more opportunities to be physically active, but intentions did not translate into behaviour. The lack of relationship between intention and physical activity is not unique to this study, and this discordance between those who intend to be physically active, but do not complete the behaviour is estimated to be about 46% (Rhodes & de Bruijn, 2013). Researchers also suggested that measuring intention in terms of strength rather than a simple dichotomous decision is a better predictor of behaviour (Rhodes & Rebar, 2017). In our sample, misinterpretations of the construct as a decision rather than intensity of determination may have resulted in the lack of relationship between intention and behaviour. Several strategies to overcome this 'gap' between intention and behaviour could be applied in a Chinese university context. For example, planning (Reuter et al., 2010; Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2008; Sniehotta, Scholz, & Schwarzer, 2005), and action control (i.e., self-monitoring, awareness of standards, and self-regulatory effort Sniehotta et al., 2005) have been identified as mediators between intention and physical activity. Chinese university students may benefit from learning how to properly plan their physical activity,

monitor their behaviour and progress, learn about physical activity recommendations, and set goals to regulate their behaviour in order to increase health promoting physical activity.

The environment or setting in which one lives can impact physical activity, and even interact with social support to influence physical activity in some cases (Carlson et al., 2012; Kwasnicka, Dombrowski, White, & Sniehotta, 2016). In the present model, we assessed perceptions of places to be active, and these were unrelated to LTPA through intentions, although students who had higher self-efficacy perceived more opportunities to be physically active. It is possible that knowing one can access opportunities to be active, and feeling like one is able to complete the behaviour is not enough to promote LTPA in this population. Cerin and colleagues (2010) found that in Australian adults, perceived barriers to LTPA were related to several factors (e.g., motivational barriers were related to motivational, social, and environmental factors). In the current study, the students may lack the motivational components (e.g., self-efficacy, intention) to translate access perceptions into action. Furthermore, Chinese university students may not prioritize physical activity over academic work, and they may prefer to engage in more passive, low arousal activities during their leisure time even if they are aware of places to do physical activity (Walker & Wang, 2008). Environmental factors such as air pollution or weather could also be important contextual factors at play in this population, especially considering many facilities for physical activity may be located outdoors in a more southern province (Guan, Zheng, Chung, & Zhong, 2016).

A key variable in the model was social support. Those who perceived higher social support reported better self-efficacy and more VPA. Recent research with Australian adolescents found an interaction between social support and self-efficacy on intentions to do VPA such that social support helped those with low self-efficacy improve their intentions, but more social

support only partly buffered low self-efficacy (Hamilton, Warner, & Schwarzer, 2017). When measured in a Western context with other SCT variables, the effect of social support is largely indirect, or has only a small influence on physical activity, while self-efficacy emerges as a strong predictor of physical activity (Anderson et al., 2006; Ayotte et al., 2010; Rovniak et al., 2002).

The importance of social support in the current SCT model demonstrates the complexity of support seeking in those with an interdependent self-construal. Indeed, our sample rated themselves higher on interdependent self-construal compared to independent self-construal, a finding that confirms the importance of measuring personal factors related to culture to help explain behaviour. The bivariate correlations indicated that independent self-construal is more strongly related to social support, intention, self-efficacy, and access compared to interdependent self-construal. The direct link between social support and LTPA could be stronger for Chinese students who endorsed a more independent self-construal because they may be more likely to seek out support from their peers (Kafetsios & Nezlek, 2012; S. E. Taylor et al., 2004).

Chinese students may be especially aware of the expectations of their peers, and desire to achieve social harmony (Hudson et al., 2013). As Hudson et al. (2013) described, Chinese-Canadian skiers may perceive an obligation to maintain social cohesion with important people in their group, resulting in perceptions of interpersonal constraints to their behaviour. In general, more interdependent cultures aim to maintain social harmony; if your friends support and/or participate in physical activity, you are more likely to engage in these activities to maintain positive social relations, and avoid rejection (Kitayama et al., 2007). This may involve resistance to seeking support from friends unless it is clear that they endorse the behaviour, or seeking activities that will facilitate relationship building.

Bandura (2002) described three types of agency in SCT: direct personal agency, proxy agency which is socially mediated (i.e., one relies on others to act on their behalf to reach a goal), and collective agency that requires group action. The importance of social support for the Chinese students could be an indication that their social environment not only supports their beliefs in their personal agency or self-efficacy, but it may also facilitate a blend of both proxy and collective agency beliefs needed to meet physical activity goals. Again, this blend may depend on self-construal endorsement, and whether one is motivated to engage in support seeking. The relationships between social support and these types of self-efficacy, and the moderating role of self-construal could be examined in future studies. If social motivations are paramount for Chinese students, social networks could be leveraged among Chinese university students to encourage LTPA. This may include offering group exercise opportunities, creating buddy systems, behavioural contracts, or creating physical activity support groups (Heath et al., 2012).

Another area of interest in the current model was the lack of association between the SCT variables and MPA. Students reported doing more MPA compared to VPA (about 4 days versus 2 days per week on average). Student lifestyle could help explain these findings as MPA may include much of the student's transportation. For example, many students may use bike sharing to get around campus and other parts of the city (Lipton, 2017). Because MPA is built into the student's daily lives, it may not require behavioural regulation or self-efficacy, and students may not consider it a deliberate source of physical activity. That is, students may not require the skills described in SCT to engage in MPA.

Limitations

The present research is not without limitations. The intention variable used a single item which may not represent all the self-regulatory mechanisms underlying LTPA (e.g., planning). In addition, the access variable had relatively low factor loadings, meaning that the questions may not strongly represent the 'access' construct. This may be due to differences between perceptions of access within the university context and outside of it. The data presented are cross-sectional, so causal relationships cannot be inferred. Future research may also benefit from a more objective measure of LTPA. The results may also not be generalizable to all Chinese university students because the physical activity of university students in different areas of China may vary due to climate, air pollution, or other conditions.

2.7.5. Conclusion

For Chinese university students, social support may be the most important factor associated with VPA. Self-efficacy appears to play a secondary role in supporting intentions to do physical activity and perceptions of access to places to be physically active. In addition, MPA may simply be a part of everyday life for these students and could lack requirements for the same amount of psychological support compared to VPA. These findings contribute important theoretical and practical implications and solidify the need to examine correlates of physical activity in context to meaningfully explain behaviour.

Table 2.9.

Supplement 1. Unstandardized, standardized estimates and standard errors for identified paths in the model study one part II

	1	2	3	4	5	6	7	8	9
1. Age	--	--	--	0.09(0.05)	-0.15(0.06)*	-0.04(0.03)	-0.09(0.07)	0.02(0.06)	-0.04(0.06)
2. Sex	--	--	--	0.05(0.06)	-0.27(0.06)**	0.00(0.04)	-0.98(0.08)	-0.15(0.05)*	-0.01(0.07)
3. BMI	--	--	--	0.04(0.07)	0.09(0.06)	0.02(0.04)	-0.06(0.08)	-0.02(0.06)	0.02(0.07)
4. Social Support	0.46(0.03)	0.09(0.10)	0.01(0.02)	--	0.41(0.05)**	--	--	0.29(0.05)*	--
5. Self-efficacy	-1.76(0.66)*	-9.57(2.28)**	0.70(0.47)	9.14 (1.26)**	--	0.67(0.08)**	0.56(0.09)**	0.14(0.11)	0.17(0.18)
6. Intention	-0.05(0.04)	0.02(0.17)	0.03(0.03)	--	0.07(0.01)**	--	0.11(0.09)	0.10(0.08)	0.13(0.09)
7. Access	-0.07(0.05)	-0.24(0.19)	-0.03(0.04)	--	0.03(0.01)**	0.17(0.15)	--	--	--
8. VPA	0.14(0.50)	-3.78(1.42)*	-0.09(0.35)	4.48(1.64)*	0.10(0.08)	0.72(0.55)	--	--	--
9. MPA	-0.22(0.36)	-0.19(1.39)	0.10(0.30)	--	0.09(0.10)	0.73(0.49)	--	--	--

Note. Unstandardized coefficients are located below the diagonal, and standardized coefficients are located above the diagonal. Standard errors are in brackets following the estimates. BMI = Body mass index; Intention = intention to be physically active; Access = perceived access to physical activity opportunities; VPA/MPA = vigorous or moderate intensity leisure time physical activity. Sex was coded as male = 1, female = 2.

**$p < .001$, *$p < .01$.

Table 2.10.

Supplement 2. Estimated covariance matrix study one part II

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. VPA	168.42													
2. MPA	14.51	97.97												
3. TSK	86.20	40.39	524.47											
4. COPE	88.19	37.54	358.38	587.28										
5. SCHD	104.04	47.74	477.49	440.28	653.30									
6. Intention	7.20	3.96	25.88	18.93	29.23	3.18								
7. Access OUT	2.07	1.02	7.51	8.30	9.23	0.65	3.06							
8. Access UNI	1.42	1.13	8.48	3.61	10.42	0.77	0.78	2.48						
9. SS5	3.23	0.68	4.86	5.37	5.97	0.34	0.10	-0.08	0.88					
10. SSP1	3.89	0.81	5.86	6.47	7.20	0.42	0.12	-0.10	0.56	0.85				
11. SSP2	3.26	0.68	4.92	5.43	4.71	0.35	0.10	-0.08	0.47	0.57	0.79			
12. Age	0.13	-1.18	-3.57	-3.95	-4.39	-0.41	-0.20	-0.30	0.10	0.11	0.10	2.48		
13. Sex	-1.22	-0.46	-2.49	-2.75	-3.06	-0.20	-0.09	-0.13	0.02	0.02	0.02	0.02	0.25	
14. BMI	2.28	1.85	7.70	8.50	9.46	0.70	0.13	0.18	0.03	0.04	0.03	-0.05	-0.35	5.56

Note. SSP1/2= social support parcel 1/2; TASK= task self-efficacy, COPE = coping self-efficacy, SCHD = scheduling self-efficacy; Access= perceived access to places to be physically active; Intention = intention to be physically active; UNI/ OUT = perception of access to places to be active in the university or OUTside the university; VPA/MPA = vigorous or moderate intensity leisure time physical activity; BMI = body mass index.

2.8. Study One, Part III: Physical activity and mental health: Modelling relationships between vigorous and moderate physical activity, stress, and subjective well-being in Chinese university students

2.8.1. Introduction

The benefits of physical activity for positive physical and mental health outcomes are well established (Penedo & Dahn, 2005; World Health Organization, 2017). Specifically, physical activity and physical fitness can buffer the effects of stress (Gerber & Pühse, 2009), and improve feelings of happiness (Wang et al., 2012). Approximately half of university students in China were not sufficiently active to obtain these health benefits (Irwin, 2004). University students are in a unique period in their lives as they are developing both academic and healthy life skills such as engaging in physical activity. For Chinese college students in particular, mental health issues such as anxiety, depression, poor sleep, and psychopathological symptoms were negatively related to physical activity, while low physical activity and more screen time were related to increased risks for these mental health issues (X. Wu et al., 2015). Academic achievement is highly regarded in Confucian tradition, and the value placed on academic performance could lead to added stress in Chinese students (Hau & Ho, 2010). Researchers examining ideal affective states in Asian cultures have found that Chinese students may prefer more moderate intensity activities to achieve their preferred mental state (Tsai, Knutson, & Fung, 2006). Examining relationships between physical activity types and mental health outcomes such as stress and subjective well-being (SWB) would be beneficial in informing promotion efforts for Chinese students.

Stress and SWB are two important mental health outcomes that have been examined in relation to physical activity behaviour. Prolonged stress can lead to serious negative

physiological and psychological consequences (Brosschot, 2010). Furthermore, among Chinese adolescents, school-related stress was associated with smoking, alcohol use, and depressive symptoms (Unger et al., 2001). In a prospective analysis, Jonsdottir and colleagues (2010) found that low or high intensity physical activity lead to better mental health over time (i.e., fewer symptoms of depression, burnout, and stress), and those who did high intensity physical activity had fewer symptoms of anxiety. The prospective data mimicked their cross-sectional findings, but the measurement of two physical activity intensities may allow a more prescriptive approach for using physical activity as a stress reduction tool. For instance, Gerber and colleagues (Gerber, Brand, et al., 2014) measured physical activity using actigraphy in a Swiss sample, and found that those who did vigorous intensity physical activity had more mental health benefits (e.g., reduced stress, fewer depressive symptoms, less perceived pain, better sleep) than those who did moderate physical activity.

Other research by Gerber and colleagues, (Gerber, Jonsdottir, Lindwall, & Ahlborg, 2014) examined the physical activity of Swedish health care workers with differing mental health profiles. They found that people with better mental health did more physical activity compared to those who had more mental health problems, even though they had similar stress levels. The authors suggested that physical activity may offer a break from occupational demands, better fitness may lessen physiological reactivity to stress (Hamer, Taylor, & Steptoe, 2006), physical activity may improve sleep (Loprinzi & Cardinal, 2011), or physical activity may promote other personal and social resources (e.g., mental toughness) to mediate the effect of activity on stress (Gerber, Kalak, et al., 2012). Chu and colleagues (2018) examined a diverse Asian population to determine relationships between self-reported physical activity in different domains (e.g., leisure, work, and transportation), objective physical activity, and psychological

distress. Importantly, leisure time physical activity was associated with less psychological distress. Considering that university students typically have very little work related physical activity, leisure time physical activity is likely a method Chinese university students could use to reduce stress, but relationships between moderate and vigorous intensity physical activity and stress should be further understood to better inform promotion efforts.

In addition to reducing stress, physical activity may help improve happiness or subjective well-being (SWB; Pedisic, Greblo, Phongsavan, Milton, & Bauman, 2015). From a hedonic point of view, good SWB can be described as frequently feeling pleasant emotions, infrequently feeling negative emotions, and high life satisfaction (Tov & Diener, 2007). Like stress and physical activity, the relationships between physical activity and SWB are likely bidirectional. For example, in a cross-cultural analysis, Grant and colleagues (Grant, Wardle, & Steptoe, 2009) found that higher life satisfaction was linked with not smoking, physical exercise, and fruit intake in Pacific Asian regions.

Engaging in effortful physical activity was also directly related to positive affect, and frequency of physical activity was related to positive affect, satisfaction, and personal expressiveness in a sample of Canadian university students (Sylvester, Mack, Busseri, Wilson, & Beauchamp, 2012). This idea of effortful physical activity may speak to intensity of physical activity as an important factor in the relationships between physical activity and SWB which was examined in another study of university students in Croatia (Pedisic et al., 2015). Only vigorous intensity physical activity was related to life satisfaction in this sample, leading to the conclusion that simply looking at overall physical activity levels in relation to life satisfaction may be misleading (Pedisic et al., 2015). Richards, Jiang, and Kelly (2015) also found that only walking and vigorous physical activity had relationships with happiness in their analyses of data

from 15 European countries. Conversely, Wicker and Frick (2015) analysed the relationship between physical activity intensity and duration using data from 28 European countries and found that more vigorous physical activity reduced SWB, while moderate intensity physical activity improved SWB. There appears to be little consensus on the ideal physical activity intensity for SWB or stress benefits, but analysing patterns in specific populations may be an effective way of addressing this issue.

The purpose of this research was to examine a model of physical activity and its relationship to stress and SWB in a sample of mainland Chinese undergraduate students (see Figure 2.3). Differentiating two physical activity intensities (i.e., moderate and vigorous) could help determine types of physical activity that can be linked to mental health outcomes, and examining stress and SWB allows for conclusions to be made based on two distinct outcomes of leisure time physical activity (LTPA). We expected that both types of physical activity would share a positive relationship with SWB and negative relationships with stress.

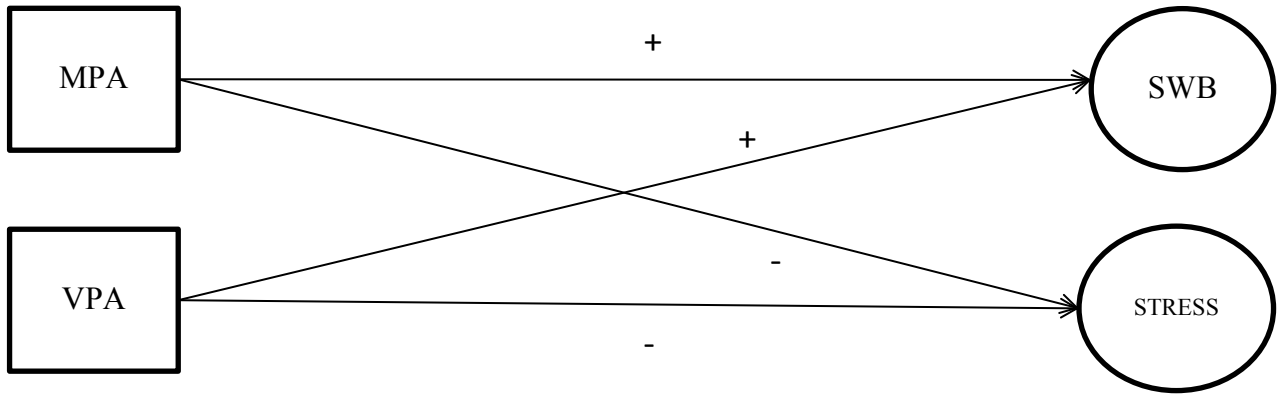

Figure 2.3. Conceptual structural equation model for mainland Chinese university students (N = 315). MPA = moderate intensity physical activity. VPA = vigorous intensity physical activity. SWB = subjective well-being. Positive signs (+) indicate an anticipated increase in the construct in relation to physical activity, and negative signs (-) indicate an anticipated reduction in the construct in relation to physical activity. Circles represent latent variables, squares represent single indicator variables.

2.8.2. Method

Procedures

See Methods section 2.2. for a description of survey translation and data collection.

Participants

Surveys were completed by 327 students. Students who were not undergraduates (i.e., master's students, graduate students; $n = 6$), and "careless responders" (took less than 200 seconds to complete the survey, combined with inspection of the individual's data; $n = 4$; Meade & Craig, 2012) were removed. Two cases with extreme scores on their LTPA measures were removed. Missing data were found to be 4% or less and therefore descriptive statistics are reported using complete cases or pairwise deletion, and the structural regression was completed using full information maximum likelihood (FIML). The mean age of the participants was 20.17 ± 1.57 and the sample was 54.9% female. First year students comprised 40.3% of the sample, 23.3% were second year students, 20.0% were third year students, and 12.7% were in their fourth year. Students were from a variety of study areas such as engineering (25.1%), humanities (15.2%), science (12.7%), medicine (10.5%), and math or finance (11.7%). Most participants had a normal BMI (M = 20.56 ± 2.36) for Asian adults (Chinese Community Health Resource Center, 2017).

Measures

The variables included in this study were physical activity, general stress, subjective well-being, exercise as a coping strategy, age, sex, and BMI. See Measures section 1.9. for a description of each of these variables. The following descriptions relate to their treatment in the structural models.

Leisure time physical activity. Calculated MET values for vigorous physical activity (VPA) and moderate (MPA) were used as single indicators in the model.

Subjective well-being. A latent SWB variable was created using average scores from the satisfaction with life scale, both types of positive affect, and negative affect. The life satisfaction and affect components of the latent SWB construct were standardised in the structural regression model.

Perceived stress. Three parcels were created by combining items with higher correlations with the latent construct and items that had lower correlations. Specifically, items 1, 2, and 10 were combined to create parcel one, parcel two consisted of items 3, 6, and 9, and parcel three included items 4, 5, 7, and 8.

Control variables. Age, sex, BMI, and exercise as a coping mechanism were included as covariates in the model.

Data preparation and analysis

Age, sex, exercise as a coping mechanism and BMI were examined for differences on physical activity, stress, and SWB using univariate ANOVAs and chi-square difference tests. MPlus version 7.2 was used to conduct the structural regression analyses (Muthén & Muthén, 1998-2012). There were many respondents who reported zero days of physical activity resulting in non-normal distributions. The MLR estimator was used to compensate for this non-normality, and adjusted model fit values and coefficients are reported. Standardized coefficients are reported.

Bivariate correlations were computed and examined for any abnormalities (Table 2.11). A confirmatory factor analysis was conducted to examine factor structure. Lastly, the structural model was tested. Local fit was evaluated by examining the normalized residuals. Global fit

statistics examined were the chi-square test (χ^2), the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the standardized root mean square residual (SRMR). We considered good fit to the data is indicated by a nonsignificant chi-square test, RMSEA and SRMR < .05, and CFI > .90 (Little, 2013).

2.8.3. Results

Preliminary data analysis and correlations

Older students (23-28 years) and male students did more VPA compared to younger students and female students (17-22 years; $p < .05$). Examination of the bivariate correlations (Table 2.11) shows small correlations between VPA and MPA, and stress and SWB in the expected directions (J. Cohen, 1988). VPA and SWB were not correlated. Stress and SWB were moderately negatively correlated, confirming that these constructs were interpreted as intended.

Measurement Model

The initial measurement model resulted in poor fit to the data (χ^2 (50) = 291.04, $p < .001$; RMSEA = .12, 90% CI [.11 - .13], SRMR = .10, CFI = .84). After inspecting the modification indices and normalized residuals, several covariances were permitted as they are conceptually linked to one another. Particularly, stress parcel 1 residuals were allowed to covary with the residuals from parcels 2 and 3. Low arousal positive affect residuals were allowed to covary with the residuals from positive affect. Residuals of items 1 and 4 from the satisfaction with life scale were allowed to covary. After these modifications, the model had acceptable fit to the data (χ^2 (42) = 52.26, $p = .13$; RMSEA = .03, 90% CI [.00 - .05], SRMR = .03, CFI = .99) that was significantly better than the initial model (χ^2_{diff} (8) = 238.78, $p < .001$).

Structural Model

The structural model was first examined without covariates (age, sex, BMI, and exercise as a stress coping mechanism). The model fit the data acceptably well (χ^2 (42) = 47.44, p = .26; RMSEA = .02, 90% CI [.00 - .05], SRMR = .04, CFI = .99). When the covariates were added to the model, there was still good fit to the data (χ^2 (75) = 105.95, p = .01; RMSEA = .04, 90% CI [.02 - .05], SRMR = .04, CFI = .97). Inspection of the covariates and their relationship with other variables in the model showed that age and BMI were not contributing to the model, and they were removed as covariates to increase model generalizability. The updated model fit the data well, and the results for the model were the same (χ^2 (59) = 84.88, p = .02; RMSEA = .04, 90% CI [.01 - .06], SRMR = .04, CFI = .98). See Figure 2.4 for detailed results of this model. Although the chi-square was statistically significant, the decision was made to accept the model because the other fit indices were acceptable, and the chi-square statistic is known to be sensitive to sample size (Hooper, Coughlan, Mullen, Hooper, & Mullen, 2008). Wheaton et al.'s (1977) relative/normed chi-square minimizes the impact of sample size and is simply the ratio of chi-square to degrees of freedom. Our model ratio was 1.4, which is below the 2.0 cut-off suggested by Tabachnick and Fidell (2014).

Not shown in Figure 2.4, sex was negatively related to VPA (β = 0.19, p = .001), indicating that females did less VPA than males. Exercise for coping with stress were positively related to MPA (β = 0.13, p = .01), SWB (β = 0.24, p < .001), and negatively related to stress (β = -0.20, p = .002). MPA was significantly negatively related to stress (β = -0.18, p = .005), and positively related to SWB (nonsignificant at p < .05; β = 0.11, p = .06). Supplement 2.12 shows the standardized and unstandardized estimates and errors for the paths in the model. Supplement 2.13 shows the estimated covariance matrix.

Table 2.11.

Bivariate correlations and descriptive statistics study one part III

Variables	Mean (*SD*)	Range	1	2	3	4	5	6	7	8
1. VPA	879.08 (1290.41)	0-7680	1							
2. MPA	913.25 (983.63)	0-5040	.12*	1						
3. Stress	27.61 (5.14)	15-46	-.12*	-.15**	1					
4. SWB	8.57 (2.26)	-1.25-13.51	.03	.15**	-.60**	1				
5. Age	20.17(1.57)	17-28	.01	-.08	.13*	-.04	1			
6. Sex	1.55 (0.50)	1-2	-.20**	-.09	.13*	.02	.03	1		
7. BMI	20.56 (2.36)	15.60-30.45	.08	.08	.14*	-.07	-.01	-.29**	1	
8. Exercise for stress	4.50 (1.05)	1-6	.09	.14*	-.16**	.28**	.03	-.08	-.01	1

Note. VPA = vigorous intensity leisure time physical activity; MPA = moderate intensity leisure time physical activity; BMI = body mass index; SWB = subjective well-being; Male = 1, female = 2; SD = standard deviation.

* $p < .05$; ** $p < .01$.

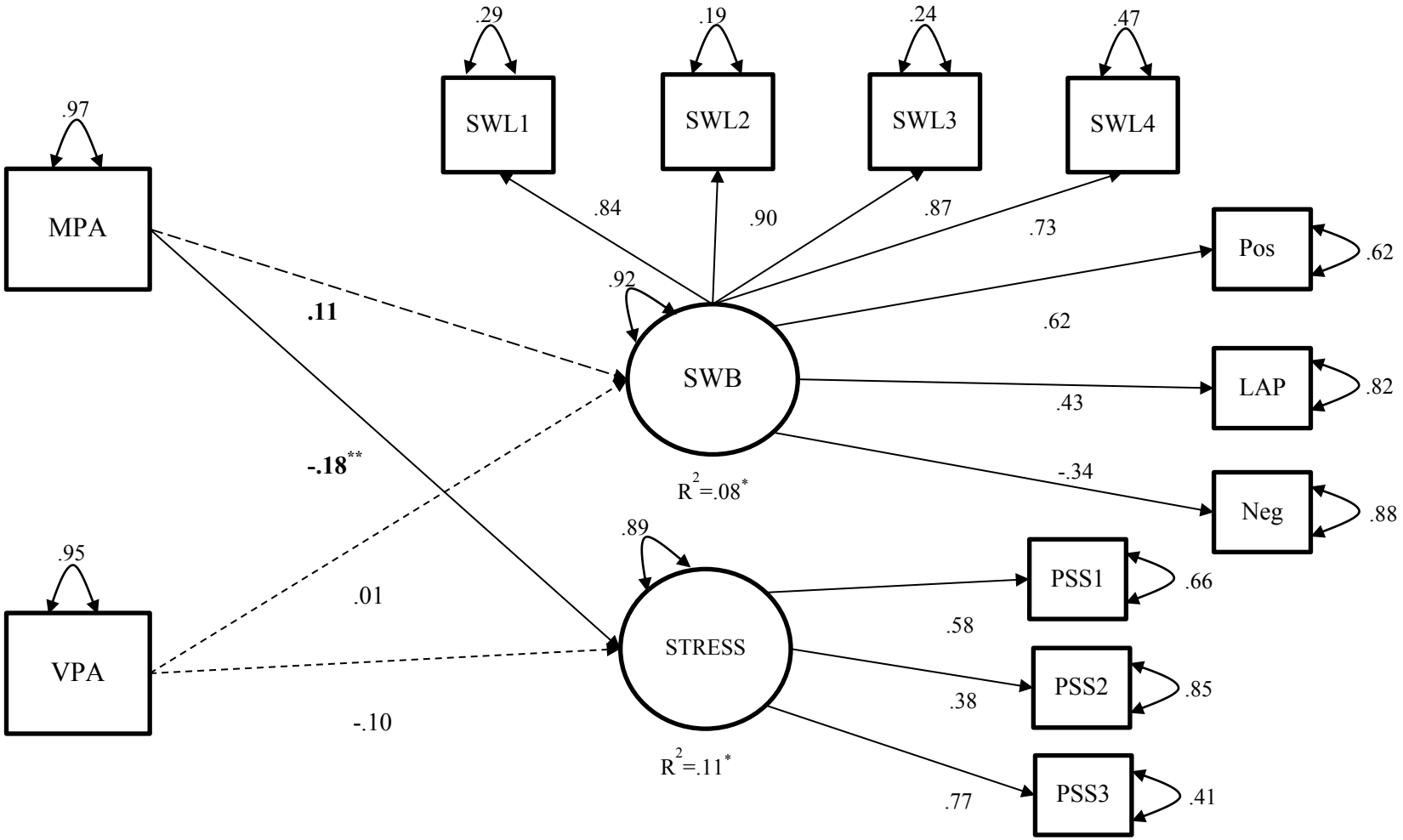

Figure 2.4. Accepted structural equation model for Chinese university students. Standardized estimates reported. N = 309. Sex and, exercise as a coping mechanism for stress included as covariates (not shown). PSS1/2/3 = perceived stress parcel 1/2/3; Pos = positive affect; LAP = low arousal positive affect; Neg = negative affect; SWL = satisfaction with life item 1/2/3/4; SWB = subjective well-being; MPA = moderate intensity leisure time physical activity; VPA = vigorous intensity leisure time physical activity. Dashed lines indicate non-significant pathways. $\chi 2$ (59) = 84.88, p = .02; RMSEA = .04, 90% CI [.01 - .06], SRMR = .04, CFI = .98

$^{**}p < .01$, $^{*}p < .05$.

2.8.4. Discussion

The present study used structural equation modelling to examine relationships between VPA and MPA, and stress and subjective well-being among Chinese university students. It was anticipated that both types of physical activity would share positive relationships with SWB, and negative relationships with stress. While all the relationships were in the expected directions, only MPA was significantly negatively related to stress. Interestingly, student's perception that physical activity can be used to reduce stress was positively related to MPA, SWB, and negatively related to stress. This shows that some students are aware of the benefits of doing physical activity to reduce stress, and possibly improve SWB, but they may not carry out the behaviour to achieve these outcomes. More research should examine the role of motivations and outcome expectations as modifying variables between physical activity and mental health.

The findings of this study are contrary to other studies that have found VPA to be related to mental health outcomes (Gerber, Brand, et al., 2014; Jonsdottir et al., 2010; Pedisic et al., 2015). However, some studies have found that MPA was better for improving SWB compared to more vigorous activities (Wicker & Frick, 2015). In the present study, VPA was essentially unrelated to SWB, but MPA showed a small relationship with the latent SWB construct. Indeed, stress appears to be a better psychological outcome measure of physical activity for Chinese students, especially considering some important cultural differences in the experience of emotion and preferred leisure time activities.

One reason that moderate intensity activities may be more conducive to stress relief, and better related to SWB compared to VPA is that they may be more in line with Chinese students' preferred affective states or settings that are more passive or low arousal (Tsai, 2007). Tsai, Knutson, and Fung (2006) found that Hong Kong students ideally liked to be quiet, serene,

happy, and positive, while their American counterparts preferred excitement. In later research, they identified that Americans valued high arousal positive states more and low arousal positive states less than Chinese or people from other East Asian cultures (Tsai, 2007). For example, Hong Kong Chinese students reported they prefer social activities, rest and relaxation, watching television, and playing nonphysical games compared to playing sports, watching sports on television, reading or writing, doing art, or outdoor activities (Tsai & Coleman, 2007). As well as offering lower arousal activities, MPA may also be more conducive to allowing social interaction which could help reduce stress and isolation, making them more appealing for Chinese students. Reviews on exercise intensity and affect have suggested that more moderate intensity activities promoted better affective outcomes, unless the intensity is self-selected (Ekkekakis, Parfitt, & Petruzzello, 2011). If Chinese students prefer moderate intensity this may lead to better affect for both reasons.

Research on emotion and culture shows that East Asian cultures with interdependent self-construals generally rate themselves lower on measures of happiness or SWB compared to those in Western, individualistic cultures, despite similar objectively measured life conditions (Diener & Suh, 2000; Triandis, 2000). Reasons for this include a propensity for Asian cultures to tone down their self-assertiveness and individuality, have lower self-enhancement and self-consistency, and report lower self-esteem (Diener & Suh, 2000; Suh, 2002). Asians generally rely heavily on relational norms and their understanding of expectations of others when expressing how they feel, and may not value happiness as an individual pursuit as is common in Western cultures (Diener & Suh, 2000). Chinese expressions of emotion have origins in Buddhism and Taoism which both reflect spiritual enrichment and the power of the mind as paths to happiness over hedonic pleasure, material possessions or physical comfort (Lu, 2010).

From a Taoist perspective, harmony between heaven, earth, and people would lead to happiness. A dialectic balance is emphasized, where happiness and unhappiness coexist and are both necessary (Lu, 2010). Furthermore, happiness often is considered a trait rather than a state, and therefore a behaviour such as physical activity may have little effect on this more stable mental attribute (Lu, 2010).

The cultural and conceptual factors discussed could contribute to different perceptions or inconsistencies in the measurement of SWB in this sample, and despite the strengths of measuring this construct using a latent structure, the conceptualization and measurement of SWB may need to be adjusted to account for these culturally based interpretations of the construct. For instance, balance, and spiritual enrichment could be considered as ways to examine happiness or SWB in Chinese populations in future studies. There is also evidence that the measurement of SWB should be conceptualized as positive affect, negative affect, and life satisfaction separately. Our model, however, did not fit the data when the model was tested with these separate indicators. In their meta-analysis of LTPA and SWB in working adults, Wiese, Kuykendall, and Tay (2018) found stronger relationships between physical activity and positive affect compared to life satisfaction, and physical activity may not be related to negative affect. It could be that physical activity is more closely related to the physiological components of positive affect rather than the more broad cognitive evaluations involved in life satisfaction (Wiese et al., 2018). Related research by Hall, Ekkekakis and Petruzello (2002) found that vigorous physical activity increased energetic arousal and decreased tension post-exercise. For negative affect, Weise and colleagues suggested that the needs of mastery and autonomy that are met through physical activity may be more related to positive affect than negative affect (Tay & Diener, 2011; Wiese et al., 2018). Only one of the studies included in the analysis used a Chinese sample (Jiang, Qin,

Ke, & Ying, 2011), and therefore the optimal structure of the SWB construct in Chinese populations should be further studied.

Kline (2016) suggested that interpretation of structural models should rely less on significance testing, and more on effect sizes and overall model fit. The effect sizes in the present model suggest both VPA and MPA may play a small role in reducing stress and improving SWB, respectively. While the effect of physical activity on the mental health variables is relatively small, considering the physical health benefits of physical activity, it is reasonable to suggest that the present results support promoting physical activity to Chinese university students. MPA appears to be sufficient to achieve mental health benefits, and as a result physical activity may be more accessible for students who may not feel they can or want to engage in a higher intensity of activity.

Limitations

The current study is limited in its predictive capacity due to the cross-sectional design, and directionality cannot be assumed. The SWB construct as measured may have been limited in its applicability to a Chinese sample, despite the strength of the latent variable approach, and the inclusion of the low arousal positive affect frequency. Physical activity was self-reported, and could be inaccurate due to recall error or self-presentation bias. Generalizability of the study is limited due to the use of university students who may not be representative of all young adults in China.

2.8.5. Conclusion

This study adds to the literature on psychological health outcomes of physical activity using a sample of mainland Chinese university students. Specifically, MPA may be important for reducing stress in this sample. MPA may also beneficial for improving SWB, and VPA could

help to reduce stress. Student program coordinators and academic counsellors should encourage students to engage in physical activity especially during stressful times in their school careers because it may serve to reduce these potentially harmful feelings.

Table 2.12.

Supplement 1. Unstandardized, standardized estimates and standard errors for identified paths in the model study one part III

	1	2	3	4	5	6
1. Sex	--	--	-.10(0.06)	-0.19(0.06)**	0.07(0.06)	0.06(0.06)
2. Exercise cope	--	--	0.13(0.05)*	0.08(0.05)	0.24(0.06)**	-0.21(0.07)*
3. MPA	-2.04(1.13)	1.18(0.51)*	--	--	0.11(0.06)	-0.18(0.06)*
4. VPA	-5.06(1.49)*	0.95(0.59)	--	--	0.01(0.05)	-0.10(0.06)
5. SWB	0.08(0.07)	0.14(0.04)**	0.00(0.00)	0.00(0.00)	--	
6. Stress	0.05(0.05)	-0.08(0.03)*	-0.00(.00)*	-0.00 (0.00)	--	--

Note. Unstandardized coefficients are located below the diagonal, and standardized coefficients are located above the diagonal. Standard errors are in brackets following the estimates. SWB = subjective well-being; exercise cope = exercise as a way to cope with stress; VPA = vigorous intensity physical activity; MPA = moderate intensity physical activity. Sex was coded as male = 1, female = 2. SWB variables were standardized prior to entry into the model

**$p < .001$, *$p = .001$.

Table 2.13.

Supplement 2. Estimated covariance matrix for observed variables study one part III

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Stress	0.17														
2. SWB	-0.17	0.38													
3.LS1	-0.23	0.52	1.00												
4.LS2	-0.25	0.55	0.76	1.00											
5.LS3	-0.24	0.54	0.74	0.79	1.00										
6. LS4	-0.20	0.45	0.50	0.66	0.64	1.00									
7. Positive	-0.17	0.38	0.52	0.55	0.54	0.45	1.00								
8. Negative	0.10	-0.21	-0.29	-0.31	-0.30	-0.25	-0.09	1.00							
9. Low Arousal Positive	-0.12	0.27	0.36	0.39	0.38	0.31	0.46	-0.15	1.00						
10. VPA	-0.71	0.20	0.27	0.29	0.28	0.23	0.20	-0.11	0.14	167.77					
11. MPA	-0.86	0.83	1.13	1.21	1.17	0.98	0.83	-0.46	0.57	4.11	95.05				
12. Stress 1	0.17	-0.17	-0.23	-0.25	-0.24	-0.20	-0.17	0.41	-0.12	-0.71	-0.86	0.49			
13. Stress 2	0.11	-0.11	-0.16	-0.17	-0.16	-0.14	-0.11	0.38	-0.08	-0.48	-0.58	0.36	0.50		
14. Stress 3	0.18	-0.18	-0.25	-0.27	-0.26	-0.22	-0.18	0.20	-0.13	-0.77	-0.93	0.11	0.12	0.33	
15. Exer. for stress	-.11	0.16	0.22	0.24	0.23	0.19	0.16	-0.09	0.11	1.26	1.38	-0.11	-0.07	-0.11	1.11
16. Sex	0.02	0.01	0.01	0.01	0.01	0.01	0.01	-0.01	0.01	-1.29	-0.55	0.02	0.02	0.03	-0.04

Note. SWB = subjective wellbeing; LS 1/2/3/4 = life satisfaction items; Positive = positive affect; Negative = negative affect; Low Arousal Positive= low arousal positive affect; VPA = vigorous intensity physical activity; MPA = moderate intensity physical activity; Stress 1/2/3 = stress parcels from perceived stress scale; Exer. For stress = perception of stress as a way to cope with stress.

Chapter 3: Study Two

Stressed and lonely: Social cognitive, cultural, and mental health relationships to physical activity in first year mainland Chinese international students in Canada

3.1. Introduction

Canada is a popular destination for those seeking an international student experience. From 2010 to 2017, there was a 119% increase in international students in Canada (Canadian Bureau for International Education, 2018). Additionally, in the 2016-2017 academic year (September through April), about 13% of the University of Alberta population was composed of undergraduate international students, representing 94 countries (University of Alberta, 2018). Chinese students comprised the largest international student group, accounting for over 74% of the undergraduate international student population (University of Alberta Data Warehouse, 2017). Furthermore, in 2017 Chinese students represented 28% of the total international student population in Canada (Canadian Bureau for International Education, 2018).

According to the Canadian Bureau for International Education (2018) international students choose to study in Canada because of the quality of education, and perceptions that Canada is tolerant, non-discriminatory, and safe. Research has shown, however, that adjusting to a new country can be stressful due to many factors such as language issues, learning about a new culture, financial problems, academic stress, perceived discrimination, and social interaction (Sherry et al., 2010; Smith & Khawaja, 2011; Zhang & Goodson, 2011b). These issues are part of acculturation and are associated with acculturative stress. Many institutions offer programming to help students adjust such as language training and orientation efforts. Another way to encourage international student adjustment is through physical activity. Physical health benefits of physical activity are well established (e.g., reduced risk of mortality, and reduced risk

for heart disease; Warburton et al., 2010), but physical activity could help Chinese and other international students adjust to life in a new country through decreased acculturative stress (Smith & Khawaja, 2011). Physical activity rates among Chinese international students are not sufficient to achieve these physical and psychological benefits. Many Chinese international students are less physically active compared to non-international students (Yoh et al., 2008). Research in the United States examining the processes of students adjusting to a new culture has found that students from North America spent the most time being physically active, while students from Asian and African countries were the least physically active.

In addition to the physiological stress relieving benefit of physical activity (e.g., (Mikkelsen, Stojanovska, Polenakovic, Bosevski, & Apostolopoulos, 2017), recreational sports such as intramurals may help alleviate some stress international students experience largely by encouraging social interaction (S. Li & Zizzi, 2017). While most of the existing research focusses on more formal sport experiences (e.g., Guo & Ross, 2014), it is plausible that physical activities like walking could also provide opportunities to socialize and improve adjustment. Regardless of the mode, physical activity may share a positive relationship with acculturation to the host culture. Research with immigrants found an association between acculturation and physical activity (Gerber, Barker, & Pühse, 2012), but this could vary by age, gender and ethnicity. Other qualitative research with international students found that many of them increased their physical activity after their arrival to the United States due to role modelling from other students, increased accessibility, more time to do physical activity, a desire to interact with American students, and weight management (Z. Yan & FitzPatrick, 2016). It is important to examine the relationships between physical activity participation, acculturation, and mental

health outcomes quantitatively over time, especially because temporary residents may not be comparable to immigrants.

Acculturation is the process of sociocultural and psychological change that occurs as a result of prolonged contact between cultural groups (Berry & Sam, 2006). People may choose to completely assimilate into mainstream culture, integrate mainstream culture with their own heritage culture, separate from mainstream culture and only endorse their heritage culture, or maintain neither culture (i.e., marginalization; Berry, 1997; Berry & Sam, 2006). Acculturation is related to self-construal (how one sees themselves in relation to others). People from East Asian countries typically have interdependent self-construals which emphasize harmony in social groups and relationships with important others. People in Western cultures often endorse an independent self-construal in which people aim to be distinct and maintain individuality (Markus & Kitayama, 1991). For students with East Asian and Chinese backgrounds living in Canada, heritage acculturation was positively associated with interdependent self-construal, and mainstream acculturation was related to independent self-construal (Ryder et al., 2000). As Chinese students engage more with Western culture, they may experience acculturative stress, or culture shock, especially due to the large differences between East Asian and Western culture (Smith & Khawaja, 2011). Indeed, ethnic similarity makes for easier transitions (J. J. Lee & Rice, 2007; Ward & Kennedy, 1993). It is not known, however, how long it takes for international students to adjust to their host culture, and how that may manifest over time (Zheng & Berry, 1991).

Researchers studying acculturation have suggested that adaptation follows a U-shape, wherein fewer problems (e.g., less stress) are experienced during the beginning stages of acculturation, with more problems arising over time and eventually resolving (Shek et al., 2017;

Zheng & Berry, 1991). However, there is little evidence for this hypothesis, and stress is most likely unstable over time (Ward & Kennedy, 1993; Zheng & Berry, 1991). Ward and Kennedy (1999) posited that transitions were most difficult at the beginning stages for international students. This notion is in line with the stage conceptualization of acculturation which takes into account the personal context and resources of the person when considering their rate of adjustment (Berry, 1997). Although one study by Zheng and Berry (1991) found support for the U-shaped hypothesis in a sample of Chinese students and visiting scholars, more work over time should confirm these findings.

To encourage physical activity, it is necessary to understand why people do or do not engage in the behaviour. Social cognitive theory (SCT; Bandura, 1986a) derived from social learning theory, and posits that behaviour is determined by the interactions between the person, their environment and behaviour. The theory has been used to describe correlates of physical activity in several diverse populations (e.g., Anderson et al., 2006; Rogers et al., 2005). Specifically, self-efficacy (situation specific self-confidence) has been repeatedly shown as a main correlate of physical activity behaviour. Through self-efficacy, other SCT variables such as self-regulation (e.g., strategies designed to direct behaviour such as goal setting), and social support (e.g., friend groups) have shown relationships with physical activity (Rovniak et al., 2002). These social cognitive variables may vary, however, depending on cultural factors related to one's transitional status. Moving to another country can result in changes in cultural factors like acculturation (Berry, 2005; Ryder et al., 2000), as well as self-construal (Markus & Kitayama, 1991). These variables have shown relationships with physical activity (Jin, 2010; Walker, Caperchione, Mummery, & Chau, 2015), and it has been posited that both acculturation and self-construal could explain more about health behaviour in minority groups together than

when measured individually (Landrine & Klonoff, 2004). Among Asian American college students, adherence to European American values had a positive relationship with general self-efficacy (Kim & Omizo, 2005). Understanding how culture and SCT variables change over time can help expand theoretical knowledge and predictive ability by considering more contextual factors (e.g., length of time in Canada). Understanding changes over time can also help physical activity facilitators develop activity programs that target specific needs depending on time of year.

The purpose of this research was to examine changes in leisure time physical activity, mental health (acculturative stress, general stress, subjective well-being), SCT (self-efficacy, social support and intention to be physically active), and culture (acculturation and self-construal) variables over the first academic year for mainland Chinese international students in Canada. Over time, acculturation to Canadian culture (mainstream) is expected to increase along with independent self-construal. Self-efficacy may increase over time as students develop a schedule and become more comfortable in Canada. Social support may also increase as students meet new people.

3.2. Method

3.2.1. Procedures

After obtaining ethical approval from the University of Alberta Research Ethics Office and the University of Calgary Conjoint Health Research Ethics Board, mainland Chinese students who were over the age of 17 studying at the University of Alberta or the University of Calgary were contacted through the Chinese Scholar's and Students Association (CSSA) at each university, other Chinese student groups (e.g., Chinese Students Club), through posters on campus, and presentations in classes. Online surveys were administered at two time points to

examine changes in the selected variables from the students' first months in Canada (T1; September 18 – November 23, 2017), and three to six months after they began their academic term (T2; February 27 – April 15, 2018). Those who volunteered to participate were given information about the study and a link to first survey (T1). Consent was implied if participants proceeded to the survey following the information letter. Beginning in February, participants were contacted to complete the second part of the study via email (T2). Participants who did not complete the survey within a week were sent a reminder email (up to 4 reminders). In the interest of reducing attrition, participants who completed both time points were eligible to win a $100.00 CAD gift card.

3.2.2. Measures

Please see methods section 2.2 for an overview of the translation and section 2.4. for results of the EFA. In this study we examined self-efficacy, intention, social support, acculturation, self-construal, stress, exercise to cope with stress, SWB, acculturative stress, and LTPA. See Measures section 1.9. for a description of the measures used.

Demographics. Information on age, sex, height, weight, program of study, and year of study were collected. Body mass index (BMI) was calculated using height and weight (kg/m^2).

3.2.3. Participants

The final sample at T1 included 54 participants (50% female). Of these, $n = 50$ were from the University of Alberta, and $n = 4$ were studying at the University of Calgary. Participants who completed T2 ($N = 22$; 59% female; 41% retention rate) did not differ on any of the variables compared to those who did not complete the survey at T2.

Participants were from various programs including engineering (n =16), economics, (n = 12), computer science (n = 6), science (n = 3), psychology (n = 4), and other programs such as arts, agriculture, human geography, and language.

3.2.4. Data Preparation and Analysis

Due to the low retention rate of participants over time, bivariate correlations were calculated and examined for trends over time that may be relevant for this population. To compare T1 and T2 data, repeated measures analyses of variance (RM ANOVAs) were computed for all the SCT, culture, and mental health variables.

3.3. Results

3.3.1 Preliminary Analyses

Data were first analyzed for missing data, normality and outliers. No differences between time, gender and BMI were found on the independent and dependent variables. Maximum 12% of data were missing for any variable, and missing completely at random according to Little's MCAR test ($p > .05$). Missing data were handled using multiple imputation (m = 5), and pooled results are reported. Five imputations were noted as acceptable for small samples (Tabachnick & Fidell, 2007). All models were successfully replicated with mean substitution. Mean days or minutes of physical activity was inserted for participants who only included one piece of this information. Univariate outliers ($z > 3.20$) were recalculated to be within 3 standard deviations of the mean. No multivariate outliers were identified using Mahalanobis distances. Skewness and kurtosis values along with visual inspection of the variable distributions indicated the data were normally distributed. Table 3.1 shows the means and standard deviations of the variables included in the analyses.

3.3.2. Time 1 and Time 2 comparisons

The RM ANOVAs showed that the only variable that changed from T1 to T2 was students' general stress, which was higher at T2, $F(1,21) = 10.69$, $p = .004$, partial $\eta^2 = 0.34$, $\omega^2 = .30$ (M T1 = 34.14 ± 5.97; M T2 = 38.81 ± 7.36).

3.3.3. Correlations

Correlation tables were examined to look for patterns over time in the variables (Tables 3.2-3.3). The physical activity variables were uncorrelated over time. For the SCT variables, social support at T1 was correlated with VPA and intention at T2. Self-efficacy and MPA at T2 were correlated. Intention was correlated over time, and at T1 intention was correlated with MPA, walking and self-efficacy. At T2, intention was correlated with VPA, MPA, and self-efficacy. Among the culture variables, acculturation to Canadian culture was correlated over time, and at T1 was correlated with intention at T1. Canadian acculturation and independent self-construal were negatively correlated at T2. As expected, however, interdependent self-construal and Chinese acculturation were positively correlated at T2.

The mental health variables had several significant correlations. Social isolation, academic pressure, language insufficiency, family guilt, stress, exercise as a coping mechanism, SWB, and discrimination were correlated across time points. Social isolation was also correlated with language insufficiency at both time points, and academic pressure at both time points was correlated with social isolation at T2. Social isolation at T1 and T2 was negatively correlated with SWB at T1, as well as T2 for both variables. Stress and social isolation at T2 were correlated. Stress at both time points was correlated with discrimination at T1 and academic pressure at T1. Discrimination at T2 was correlated with VPA and MPA at T1, and negatively correlated with SWB at T2. Discrimination at T1 was correlated with family guilt at T2. Exercise as a way to cope with stress was positively correlated with discrimination at all time points.

Subjective well-being at both time points was negatively correlated with academic pressure at T2, and stress at both time points.

Table 3.1.

Means and standard deviations of the variables included in study two

Variable	T1		T2	
	Mean (SD)	Range	Mean (SD)	Range
VPA	467.27 (856.78)	0-2880	636.41 (941.03)	0-2881
MPA	407.27 (689.36)	0-2400	240.49 (364.60)	0-1440
Walking	1404.22 (955.16)	0-3564	1239.00 (1164.67)	132-4158
Self-efficacy	41.89 (24.05)	0-88.89	37.58 (20.56)	5.33-67.78
Intention	3.61 (2.01)	1-7	3.18 (1.87)	1-7
Social support	1.58 (0.79)	1-3.6	1.76 (0.77)	1-3.6
Chinese acculturation	6.19 (1.51)	2.77-8.4	6.69 (1.07)	4.90-8.7
Mainstream acculturation	5.47 (1.05)	2.92-7.1	5.77 (0.70)	3.9-7.1
Independent SC	3.54 (0.49)	2.78-4.47	3.49 (0.63)	2.67-5
Interdependent SC	3.96 (0.59)	2.86-5	3.99 (0.57)	3-5
Language	3.41 (1.18)	1.6-6.1	3.29 (1.10)	1.6-5.70
Social isolation	3.34 (1.32)	1.22-6.22	3.54 (1.38)	1.5-6.38
Guilt Towards family	3.37 (1.51)	1-7	3.41 (1.57)	1-6.33
Discrimination	2.37 (1.03)	1-4.5	2.33 (0.95)	1-4.29
Academic pressure	4.50 (1.65)	1-7	4.32 (1.83)	1.5-7
General stress	34.14 (5.97)*	19-47	38.82 (7.31)*	28-53
SWB	6.98 (3.86)	-0.79-12.68	6.89 (3.38)	-1.10-12.24
Exercise to cope with stress	3.79 (1.75)	1-6	4.18 (1.35)	1-6
Age	19 (1.23)	17-22	-	-
BMI	21.81 (4.30)	16.41-34.58	-	-

Note. Pooled results are shown (m= 5); $N = 22$. VPA = vigorous intensity physical activity; MPA = moderate intensity physical activity; SWB = subjective well-being; BMI = body mass index.

*$p < .01$.

Table 3.2.

Social cognitive, culture variables, and physical activity correlations at time 1 and time 2

	1	2	3	4	5	6	7	8	9	10	11	12
1. VPA	1											
2.VPA T2	.14	1										
3.MPA	.31	-.04	1									
4.MPA T2	-.13	.31	.02	1								
5.WALK	.21	-.17	.34	-.18	1							
6.WALK T2	-.06	-.04	.09	.21	.04	1						
7.SE	.23	-.42	.26	-.02	.23	-.03	1					
8.SE T2	.02	.29	.13	.45*	-.20	.19	.19	1				
9.INTENT	.41	-.00	.49*	.26	.43*	.09	.53*	.31	1			
10.INTENT T2	-.03	.51*	.13	.56**	.04	.38	.05	.53*	.53*	1		
11.SS	-.07	.57**	.23	.44	.02	-.10	-.39	.25	.17	.50*	1	
12. SS T2	-.26	.41	.15	.33	.25	.35	-.07	.41	.18	.71**	.54*	1
13.Chinese	-.20	-.09	.26	.11	.18	.09	-.12	.01	-.03	-.22	.18	-.07
14.Chinese T2	.25	.28	.21	-.05	.04	.08	.02	.15	-.00	.01	.31	.14
15.Canadian	.39	.06	.36	.02	.26	.10	.09	.03	.46*	.13	.22	-.04
16.Canadian T2	.03	-.00	.33	.09	-.03	.20	.18	.21	.30	.36	.28	.22
17.IND	-.18	.19	.16	-.10	.42	-.20	-.10	-.22	.04	.18	.33	.38
18.IND T2	-.22	-.03	-.03	-.13	.19	.18	-.30	-.23	-.22	-.11	.00	.08
19.INT	.28	.05	-.06	-.11	-.06	-.17	.11	-.20	-.03	-.29	-.00	-.27
20.INT T2	.26	.08	-.04	-.34	-.01	-.01	.13	-.27	-.11	-.21	-.06	-.17
21.AGE	.09	-.38	.06	-.20	.16	-.28	.32	.18	-.10	-.35	-.32	-.21
22.SEX	.19	.23	.01	-.23	.22	.06	-.22	.04	.31	.29	.30	.31
23.BMI	-.01	.12	.51*	.43*	-.08	.21	.10	.41	.34	.45*	.40	.20

Table 3.2 continued

	13	14	15	16	17	18	19	20	21	22	23
13.Chinese	1										
14.Chinese T2	.47*	1									
15.Canadian	.21	-.05	1								
16.Canadian T2	.05	.15	.52*	1							
17.IND	.26	.30	-.19	-.03	1						
18.IND T2	.35	.16	-.37	-.55**	.43	1					
19.INT	.12	.18	.09	-.28	-.18	.22	1				
20.INT T2	.13	.60**	-.18	-.11	.09	.18	.67**	1			
21.AGE	.14	-.03	-.11	-.05	-.05	.11	.05	-.14	1		
22.SEX	-.05	.10	.35	.20	.08	-.17	-.09	.00	-.23	1	
23.BMI	.06	.22	-.09	.19	.06	.12	-.05	.05	-.14	-.31	1

Note. Pooled results are shown (m= 5); $N = 22$. T1 = Time 1; T2 = Time 2; VPA = vigorous intensity physical activity; MPA = moderate intensity physical activity; SE = self-efficacy; INTENT = intention to do physical activity; SS = social support; Chinese = Chinese acculturation; Canadian = Canadian acculturation; IND = independent self-construal; INT = interdependent self-construal; BMI = body mass index.

* $p < .05$; ** $p < .01$.

Table 3.3.

Physical activity and mental health variables at time 1 and time 2

	1	2	3	4	5	6	7	8	9	10	11	12
1.VPA	1											
2.VPA T2	.14	1										
3.MPA	.31	-.04	1									
4.MPA T2	-.13	.31	.02	1								
5.WALK	.21	-.17	.34	-.18	1							
6.WALK T2	-.06	-.04	.09	.22	.04	1						
7.Language	-.24	-.00	-.26	-.29	-.14	-.08	1					
8.Lanuage T2	.03	-.11	-.12	-.34	.02	.10	.72**	1				
9.Social isolation	-.33	.10	-.31	.23	-.40	-.08	.58*	.37	1			
10.Social isolation T2	-.01	.12	-.26	.04	-.34	-.23	.50*	.60**	.59**	1		
11.Discrimination	.41	.38	.31	.06	-.29	-.10	.26	.29	.21	.34	1	
12.Discrimination T2	.48*	.09	.59**	-.04	-.13	.35	-.06	.12	-.06	-.08	.49*	1
13.Acad. pressure	.21	.27	-.07	.21	.13	-.30	.14	.29	.10	.50*	.24	-.15
14. Acad. pressure T2	-.04	-.09	-.11	.16	-.20	-.07	.11	.34	.30	.73**	.16	-.17
15.Family guilt	.10	.29	-.04	.25	-.18	.18	.02	.15	.14	.39	.20	.16
16.Familty guilt T2	.19	.29	.10	.20	-.30	-.08	.18	.20	.27	.37	.47*	.30
17.Stress	.02	.07	.13	.09	-.14	-.25	.18	.22	.33	.35	.44*	.15
18.StressT2	.34	.26	-.19	.03	-.35	-.26	.25	.37	.41	.73**	.56**	.04
19. SWB	-.03	.00	.26	-.40	.33	.12	-.03	-.06	-.53*	-.51*	-.24	.07
20. SWB T2	-.22	-.06	.18	-.09	.27	.27	-.07	-.16	-.37	-.64**	-.43*	.04
21.EMI	.43*	.40	.41	.15	.08	.28	-.02	.19	-.16	.09	.47*	.59**
22.EMI T2	.43*	.28	.32	-.22	.14	.32	.33	.55**	.07	.22	.48*	.62**
23.AGE	.09	-.38	.06	-.2	.16	-.28	.18	.25	.17	.18	-.18	-.11
24.SEX	.19	.23	.01	-.23	.22	.06	.18	.32	-.18	.11	.27	.07
25.BMI	-.01	.12	.51*	.43*	-.08	.21	-.12	-.17	.13	-.18	.30	.19

Table 3.3 continued

	13	14	15	16	17	18	19	20	21	22	23	24	25
13.Acad. pressure	1												
14. Acad. pressure T2	.59**	1											
15.Family guilt	.33	.38	1										
16.Family guilt T2	.30	.19	.73*	1									
17.Stress	.62**	.35	.34	.47*	1								
18.StressT2	.56**	.67**	.41	.40	.52*	1							
19. SWB	-.35	-.43*	-.27	-.20	-.59**	-.65**	1						
20. SWB T2	-.37	-.55**	-.29	-.40	-.51*	-.80**	.78**	1					
21.EMI	.42	.19	.25	.25	.24	.29	.03	-.08	1				
22.EMI T2	.15	.06	.31	.38	.15	.32	.09	-.14	.57**	1			
23.AGE	.12	.07	-.28	.11	.06	-.02	-.03	-.13	-.21	-.04	1		
24.SEX	.10	.10	.25	.28	-.08	.19	.24	-.17	.38	.53**	-.23	1	
25.BMI	-.15	-.09	-.23	-.09	.12	-.02	-.16	.06	.10	.03	-.14	-.31	1

Note. Pooled results are shown (m= 5); $N = 22$. T1 = Time 1; T2 = Time 2; VPA = vigorous intensity physical activity; MPA = moderate intensity physical activity; Language = language insufficiency; Acad. Pressure = academic pressure; SWB = subjective well-being; EMI = exercise to cope with stress; BMI = body mass index.

* $p < .05$; ** $p < .01$.

3.4. Discussion

This study aimed to examine changes in physical activity, social cognitive variables, mental health variables, and culture variables over the first year of study for Chinese international students studying in Canada. Examination of the correlations between time points showed several unexpected relationships and potential trends. For example, physical activity and self-efficacy were not stable over the first year (T1 and T2 unrelated). Stress and acculturative stress were positively correlated, and inversely correlated with SWB as expected. Interestingly, T2 discrimination was positively related to VPA, walking, and perceiving exercise as a coping mechanism for stress at T2. Social isolation and academic pressure, and language difficulty appear to be important variables over the first year for Chinese international students.

The only variable that changed between T1 and T2 was general stress. This finding is relevant because stress levels among international students are associated with psychological symptoms (i.e., depression, depressive symptoms, and psychological well-being; Zhang & Goodson, 2011). The U-shaped hypothesis, which suggests mental health may become worse in initial stages of transition and then improve over time may be relevant in this study, and could account for the increase in stress. The specific context of the students in the present study may also have dictated an increase in stress over time as the initial excitement of study abroad wore off and the academic load became heavier.

Another reason for higher stress at T2 may have been the time of year data was collected. While efforts were made to avoid collecting data during the final exam period, students may have been completing mid-term exams or completing major projects. Indeed, in a sample of undergraduates in the United States, academic performance was the top concern (Beiter et al., 2015). This is shown in the correlations between academic pressure and stress found in the

current study. Additionally, the data collection period for this study occurred during an exceptionally long winter that can contribute to the emotional state of students (Beyer, 2018; McLachlan & Justice, 2009). Researchers found that time management may be a critical first step to mitigating academic stress among first year college students in the United States, even over leisure activities (Misra & Mckean, 2000). In our sample, physical activity was not related to stress. This might mean that these time management skills for mitigating academic stress take priority over physical activity for Chinese students as well. In interviews with a variety of international students, Moores and Popadiuk (2011) found that leisure activities outside of schoolwork and social support were related to successful transitions. If students can manage their time efficiently, both leisure and social goals can be accomplished in physical activity settings.

Physical activity was expected to be consistent over time, and possibly improve over time. Neither of these things occurred in the present study. This could be due to the measure (IPAQ-C) which is self-report and relies on participants to recall their physical activity over the past week. The students could have been unsure about time spent on activities, and the intensity of the activities. The lack of behavioural consistency may be because the students were still adjusting to their new environment and could not develop physical activity routines. This result contrasts with research that identifies past behaviour as being strongly related to future behaviour; a relationship that is not mediated by social cognitive variables (Conner & Armitage, 1998; Norman & Conner, 2005). Past behaviour may help influence beliefs and intention about a behaviour, especially in unstable environments where the behaviour is not performed regularly (Norman & Conner, 2005). Bandura (1986b) argued that past behaviour acts as a mastery experience to boost self-efficacy. Habit formation may also explain behaviour patterns, where individuals develop a habitual response that does not require intention (Norman & Conner,

2005). The international student context may require social cognitive variables as mediators to behaviour (i.e., intention), however, as they may be experiencing new and unstable contexts even after 4-6 months (Zheng & Berry, 1991).

Of the SCT variables, intention seemed to be the most relevant for physical activity when examining the correlations over time. It was related to all the LTPA variables as well as self-efficacy. Planning and self-regulation strategies such as implementation intentions could be disseminated to international students to help them form health behaviour habits (Gollwitzer & Sheeran, 2006). In addition, social support could be utilized to encourage goal directed behaviour as social support at T1 was correlated with intention at T2, and VPA at T2. Social support may manifest for students in different ways such as providing encouragement or access to resources and has been related to self-regulation and self-efficacy in past research (Anderson et al., 2006). In qualitative research with international students in the United States, physical activity settings were noted as places where language and cultural barriers were not prominent, and they felt more able to make social connections (S. Li & Zizzi, 2017; Z. Yan & FitzPatrick, 2016). Social components of the international student experience are repeatedly shown to be important correlates of health and successful adjustment, and should be given more research attention in the physical activity context (Berry, 1997; Sawir et al., 2007; Schartner & Young, 2016).

Related to social support, social isolation may be a dynamic factor at play in the lives of first year Chinese international students. The correlations in this study showed that social isolation was positively related to stress, academic pressure, and language insufficiency, and negatively related to SWB. Language issues have been previously linked with social isolation in international students (e.g., McLachlan & Justice, 2009; Yeh & Inose, 2003), and they can interfere with participation in academic settings such as class discussions (S. Li & Zizzi, 2017).

Researchers found that young adults with different levels of isolation had different coping responses to stressors. Specifically, those who were high in social isolation were more likely to behaviourally disengage or withdraw as opposed to seeking out support from others (Cacioppo & Hawkley, 2003). Helping students develop language skills appropriate for the academic environment will help them adjust better and potentially have better mental health during their time abroad. In the broader cultural environment, language skills may allow students to integrate with the host culture and reduce stress associated with cultural adjustment.

It was hypothesized that acculturation to Canadian culture would increase over time, but this was not the case. It is possible that the time between measurements was not long enough to see large changes in acculturation. Berry (1997) identified phase (time) as a moderator/ mediator of adaptation that arises during acculturation. There is no established timeline for the acculturation of international students, and more longitudinal research is needed to tease out times when these changes may arise (Zheng & Berry, 1991). Another unexpected outcome was the negative correlation between mainstream acculturation and independent self-construal at T2 (cf. Ryder et al., 2000). Theoretically, Canadians hold more independent self-construals, and if one is more acculturated to Canadian culture this may include an independent way of thinking and relating to others. This result could indicate an issue with instrument validity or a unique variation in the sample of students collected who did not change in their self-construal over time, but increased their mainstream acculturation. It is possible that acculturation and self-construal develop at different rates, and the few months in between measurement times do not give an accurate indication of these timelines. In addition to changes in modes of thinking in different cultures, interactions with others in a new cultural setting may result in experiences and perceptions of discrimination.

We did not anticipate the correlational relationships between LTPA and discrimination. While many international students have positive interactions with domestic students and community members, international students also experience racial discrimination, with non-White students in the United States describing discrimination as a poignant part of their international student experience (J. J. Lee & Rice, 2007). Research by Sellers et al. (2009) found no relationship between health promoting behaviours (i.e., exercise, not smoking, abstaining from alcohol use) and racial discrimination in African American men. A limitation of Sellers' research, however, was that physical activity was measured as a yes/no dichotomy. In another study, African Americans experiencing racial discrimination did more physical activity compared to those who did not experience discrimination (Borrell, Kiefe, Diez-Roux, Williams, & Gordon-Larsen, 2013). Borrell and colleagues suggested that exercise may be used to cope with the stress brought on by racial discrimination. Students in Canada may also use physical activity to reduce their stress associated with experiencing discrimination. The correlations between discrimination and using exercise to cope with stress may exemplify this relationship.

Although ethnicity did not moderate the effect of discrimination on health in a meta-analysis (Pascoe & Smart Richman, 2009), comparing African Americans to Chinese international students may not be accurate, however, as little research has been conducted on the discrimination experiences of international students in Canada. The historical context of discrimination in the United States is an important factor that limits interpretation and application of research with African Americans to the results of this study. Additionally, just as perceptions of discrimination may vary between people, they may also vary based on discrimination from fellow citizens versus host nationals. In one study, Chinese international students in Canada identified ways in which they experienced discrimination such as exclusion,

being ridiculed for their accent, being ignored or avoided, stereotyped, and having their cultural needs ignored (Houshmand, Spanierman, & Tafarodi, 2014). There is also evidence in America that European international students experienced less discrimination, likely because of their cultural and physical similarity to Americans (Poyrazli & Lopez, 2007).

In research with mainland Chinese people living in Canada, feeling that their leisure activities supported their physical health or fitness was positively related to their perceptions of discrimination (Walker, Halpenny, & Deng, 2011). The physical and social settings in which physically active leisure may take place could contribute to feelings of discrimination. For example, in a Canadian university fitness center there exist cultural norms and etiquette that may be unfamiliar for international students. This unfamiliarity with mainstream norms can extend into the recreational sport arena and experiences of discrimination can be exacerbated by language difficulty, and prejudice by peers (Doherty & Taylor, 2007). In Stodolska's (2005) framework describing discrimination in leisure settings, she notes that workplace settings support a competitive environment rarely seen in leisure. Walker et al. (2011) argue, however, that visible minorities engaging in sport or fitness in a "serious" way may encounter hostility from other participants if competition for equipment arises or winning games is on the line. Another way that students may experience discrimination is by ignoring the different needs of cultural groups leading to the "normalization of Whiteness" (Sharaievska, Stodolska, & Floyd, 2014, p. 183). Examples of this could be present in recreation provision and structure or program delivery. Typical responses to discrimination include withdrawal or passively accepting the situation (Sharaievska et al., 2014). The positive relationships between physical activity and discrimination in our sample indicated that avoidance was not the selected coping strategy. Participants may instead be altering their activity types, locations, times, and social settings to

coincide with an environment that is less threatening (Sharaievska et al., 2014). This strategy may or may not be related to using physical activity to cope with stress related to discrimination. Clearly the assumption that participating in physical activity can only result in positive mental health outcomes is inaccurate and the environments in which the activities take place should be examined and targeted to reduce discrimination.

3.4.1. Limitations

The present research is strengthened by its repeated measures design allowing for measurement of trends over time. However, the sample was small and attrition was a large issue which reduced the power of the study[1]. A post-hoc power calculation showed that the power for the correlation analysis was .73 for detecting a large effect size (Faul, Erdfelder, Lang, & Buchner, 2007). Therefore, there is room to improve the confidence in the results of the correlational analyses. Several recruitment methods were attempted to increase the sample including posters in public spaces, class presentations, in-person recruitment, recruitment through student groups and international student resources on campus, social media postings, and the draw prize incentive. Some speculations on why this population was difficult to recruit resulted from this experience; it is possible that new international students are not familiar with research practices in North America, or they felt too overwhelmed to take on another volunteer activity. The incentive may not have been adequate to encourage participation. Result of research and participant contribution may not have been clear to participants. Finally, the students did not

[1] A second round of recruitment began in September 2018 using the psychology research pool on campus and will be completed in Spring 2019.

have a strong relationship to the researcher and may not have felt a connection as a reason to participate (Dillman, Smyth, Christian, & Dillman, 2009; Groves, Cialdini, & Couper, 1992).

Measures of stress and LTPA may have been affected by weather and academic schedules despite attempts to collect data during non-exam periods. The self-report nature of LTPA may have resulted in biased responses despite showing agreement with activity logs (Macfarlane et al., 2007). Accelerometers, phone applications, or commercial fitness products could be implemented in this population to capture physical activity behaviour (Diaz et al., 2015).

3.5. Conclusions

This study examined determinants of LTPA for Chinese international students at two time points during their first year of study in Canada. Physical activity may not be stable over time for Chinese international students. Future studies should examine how to improve consistency in health behaviour, and use more accurate measures of physical activity. Study results suggest that support for students should be aimed at stress reduction through language learning and social support. Stress resulting from the adaptation process is a normal occurrence for international students. Providing supports that allow students to cope in healthy ways will result in more positive international experiences.

Chapter 4: Study Three

Older and more experienced: Comparing first year and senior mainland Chinese international students in Canada on social cognitive correlates of leisure time physical activity, acculturation, and mental health

4.1. Introduction

Transitioning to another country to pursue post-secondary education can present unique challenges that may change over time. Indeed, some research has shown that adaptation is most difficult in the early stages of transition for international students (Ward & Kennedy, 1999), and there is some evidence that adaptation may get easier as time goes on (Shek, Yu, Wu, Zhu, & Chan, 2017). Other research identified a U-shaped pattern of adaptation and stress over time, where initial levels of psychological health decline, and then return to higher levels at a later time (Zheng & Berry, 1991). Timelines for this adaptation in international students have not been identified, but strategies to enhance positive adaptation and psychological health could help ease transitions. Engaging in physical activity could help international students adapt to their new environment, and alleviate associated stress (Allen et al., 2010; Brunette et al., 2011; M. Z. Li & Stodolska, 2006). Among international students in the United States, Asian students were found to have some of the lowest rates of physical activity, which could be linked with cultural, environmental, or individual barriers (Yoh et al., 2008). Researchers found that even for Canadian born students, transitioning to university can lead to a decline in vigorous physical activity for one-third of the students who were active in high school, with only 11% the their sample becoming active once starting university (Bray & Born, 2004).

As students spend more time in, and adapt to their host country, many will experience acculturation to mainstream culture in some capacity (Berry, 1997). Acculturation is positively

associated with participation in leisure time physical activity for immigrants in general (Gerber, Barker, et al., 2012). As such, it is possible that as students advance in their academic careers, they may begin to do more physical activity. In a longitudinal study examining changes in weight and health behaviours in a sample of mostly White, female students in the United States, 29% did not exercise regularly, 59% engaged in aerobic exercise regularly, and 31% engaged in stretching exercises regularly as first year students. Only stretching rates changed significantly when measured again in their senior year (Racette, Deusinger, Strube, Highstein, & Deusinger, 2008).

Another way to measure and understand culture is through self-construal (Markus & Kitayama, 1991). This is how one perceives relationships to others and the greater community; self-construal influences cognitions, motivations, and emotions. Eastern cultures (e.g., Chinese, Japanese) are generally more interdependent, which means they value group harmony, and believe that people are not separate from one another. The needs and goals of important others should be maintained. Independent cultures (e.g., United States, Australia), value the promotion of individual goals and self-assertion. The individual's thoughts and emotions give meaning to their behaviour. For example, in a sport context, research on constraints to participating in skiing showed that interdependent Chinese-Canadians had more interpersonal constraints, demonstrating an emphasis on social benefits of participation (Hudson et al., 2013). Trends of acculturation and self-construal have not been analyzed in international student samples, nor the correlates and mental health outcomes related to physical activity. These variables can offer more insight into behavioural motivation and how changes in culture may be related to behaviour.

Correlates of physical activity can be measured in several ways and help explain how people make decisions about being physically active. Social Cognitive Theory (SCT; Bandura, 1986a) proposes a specific set of social cognitive variables that have been shown to work together to explain physical activity in several diverse populations (Anderson et al., 2006; Ayotte, Margrett, & Hicks-Patrick, 2010; Rogers et al., 2005). The basis of SCT is triadic reciprocal causality, which describes behavioural outcomes as the interplay of the person, their environment, and behaviour. One of the most important constructs in SCT is self-efficacy, which is a person's belief they can produce a certain outcome under a certain set of circumstances. Self-efficacy has been repeatedly shown as a main correlate of physical activity behaviour (Bandura, 2004). Other correlates of physical activity are outlined in SCT such as self-regulation (e.g., strategies designed to direct behaviour such as goal setting), social support (e.g., friend groups), and sociostructural factors (e.g., barriers or facilitators like access to facilities; Bandura, 2004; Rovniak et al., 2002). Factors such as acculturation and self-construal (independent or interdependent; Markus & Kitayama, 1994) may impact these social cognitive variables in addition to, and in conjunction with, year of study.

Physical activity can have benefits for international students, including reducing stress and improving happiness (Guo & Ross, 2014). This may be done through cultivating social connections, improving fitness, dealing with stressors, and helping with cross-cultural transitions (Brunette et al., 2011). There is also evidence that stress can reduce physical activity, meaning that mental health and physical activity are likely interrelated (Dougall et al., 2011; Stults-Kolehmainen & Sinha, 2014). Many international students may feel they lack time to be physically active due to competing leisure activities or academic work, lack information about activities, or do not perceive convenient facilities (Guo & Ross, 2014; Hashim, 2012).

Physical activity can act as a coping mechanism for students to deal with stress associated with transitioning to another country. As students advance in their academic careers, they may feel more pressure to perform academically, or worry about their career prospects. In a longitudinal study of university students in Hong Kong, life satisfaction did not vary over the four-year study period (Shek et al., 2017). In international students, however, different stressors and life circumstances could contribute to changes in mental health and happiness over time. Shek et al. (2017) suggested that the Chinese students may have developed coping strategies despite challenges they may face as they become more senior. This may be because of increased student engagement that helped them improve their adaptive coping and competence. Again, international students face unique barriers to engagement that may hinder the improvement of some mental health variables.

It is valuable to understand the changes that may occur over study years for senior students regarding leisure time physical activity, and the social cognitive and mental health correlates of physical activity to promote physical activity in the most effective way. Specifically, the variables of interest from SCT in this dissertation research were self-efficacy, social support, intentions to be physically active, perceived access to places to be active (sociostructural factor). The mental health variables that were explored include stress, motivation to do physical activity for stress reduction, acculturative stress, and subjective well-being. To date, differences in physical activity and these important behavioural correlates have not been examined at different stages of study for mainland Chinese international students. The relationship that culture and acculturation might have in addition to psychological variables is important to distinguish in an acculturating group. Therefore, the research questions of interest for this investigation of Chinese international students were as follows:

1. How do senior students differ from first year and second year students in physical activity-related self-efficacy and intentions, perceptions of access to places to do physical activity, social support for exercise, acculturation, self-construal, leisure time physical activity (LTPA) participation, subjective well-being, general stress, exercise for stress reduction, and acculturative stress?
2. What are the relationships between SCT variables, mental health variables, acculturation and self-construal, and three physical activity types (vigorous, moderate, and walking) for Chinese international students and do these vary by year of study?

We hypothesized that the second year and senior international students would have greater social support, mainstream acculturation, and independent self-construals due to their increased time spent in Canada. Senior students would also have lower acculturative stress, but general stress will be similar (Zhang & Goodson, 2011b). Leisure time physical activity participation and stress may not differ between study years due to an increased or steady workload. Predictions about differences in subjective well-being are not made because this attribute may be unstable in Asian cultural groups (Yik, 2010). More mainstream acculturation was expected to be related to more leisure time physical activity, and this relationship was anticipated to be stronger for the senior students (Despues & Friedman, 2007). Those with higher self-efficacy, and more social support would do more physical activity regardless of their year of study (e.g., Doerksen et al., 2009). Less stress and increased subjective well-being were expected to be related to more leisure time physical activity for all the students. Acculturation was anticipated to moderate the relationship between self-efficacy and leisure time physical activity as self-efficacy has been found to improve with acculturation to mainstream culture (Kim & Omizo, 2005). Self-construal was predicted to moderate the relationship between social support

and leisure time physical activity, with those who have a more independent self-construal doing more leisure time physical activity with more social support (Hashim, 2012; Hudson et al., 2013; S. E. Taylor et al., 2004).

4.2. Method

4.2.1. Procedures

Recruitment. After obtaining ethical approval from the University of Alberta Research Ethics Office, and the University of Calgary Conjoint Health Research Ethics Board mainland Chinese students were recruited via several avenues. Specifically, social media posts were made on the Chinese Student Club and New Chinese Generation pages. Two contacts at University of Alberta International disseminated the study information throughout their networks. Classes were visited to announce the study, but this strategy was not effective for recruiting senior students because of the dispersion of students as they move into upper year classes. In a final effort to recruit participants, a fellow Chinese graduate student and the principal investigator walked around campus and approached potential students to ask if 1) they fit the inclusion criteria, and 2) they would like to participate in the study. If these criteria were met they were given a copy of the recruitment poster and a small token of appreciation (i.e., candy or pen). Posters were continuously put up around campus. Senior students were recruited throughout the academic year, while first year students completed the survey within their first academic term (September to November 2017). Students were directed to the online survey via the SoJump.com survey platform where they read an information letter and proceeded with the study at their discretion. In the fall of 2018, more participants were recruited through the psychology research pool at the University. Participants in this pool are taking a psychology course and have the opportunity to earn course credit through participation in research projects.

4.2.2. Measures

See Measures section 1.9.

4.2.3. Participants

See Table 4.1 for participant characteristics from the first year, second year and senior groups. There were $N = 221$ students included in the sample (56.1% female). There were $n = 92$ first year students, $n = 52$ second year students, and $n = 77$ senior students. Senior students were considered 3rd year or higher. Most senior students were in their third year of study ($n = 49$), or their fourth year of study ($n = 26$), while a few were doing a fifth year ($n = 2$). Students were studying economics (24.7%), psychology (18.5%), computer science (12.9%), science (11.2%), engineering (11.2%) and several other subjects such as agriculture, arts, math, business, and languages.

4.2.4. Data Preparation and Analysis

Three student groups were generated (first year, second year, and senior) based on univariate tests that indicated no differences between third, fourth, and fifth year students (seniors). Differences were found, however between the senior student group and the first and second year students, and between the first and second year students. Differences between the final three student groups were examined using four multivariate analyses of variance (MANOVA) models grouped together based on theoretical similarity. The first model examined differences in vigorous physical activity (VPA), moderate physical activity (MPA) and walking between the groups. In the second model the SCT variables (i.e., self-efficacy, intention, and social support, access) were entered. The third model included both types of self-construal (i.e., independent and interdependent), and acculturation (i.e., mainstream and heritage), and BMI was included as a covariate in this model. The fourth model included all the mental health variables

(i.e., acculturative stress subscales, general stress, subjective well-being, and exercise as a coping strategy for stress). Follow-up tests were corrected using the Bonferroni correction. Bivariate correlations can be found in Table 4.2 In all models, if the equality of covariances assumption was violated (using Box's m test) Hotelling's trace statistic was used (Field, 2013).

Three hierarchical linear regressions were used to measure relationships between culture variables (i.e., acculturation, self-construal), SCT variables, and mental health variables were related to physical activity (i.e., VPA, MPA, walking). Variables were entered according to Field (2013) who suggests that known predictors should enter the model first followed by variables that have not previously been tested. For other perspectives on ordering variables in hierarchical regression, see Segrin (2010) and Cohen, Cohen, West, and Aiken (2003). Step 1 included year of study because this variable may be an important indicator of physical activity but may become less important compared to the other variables. Step 2 included SCT variables because these are known contributors to physical activity. Step 3 included the mental health variables which are also known to be related to physical activity. Step 4 included the culture variables to examine their contribution to physical activity beyond the SCT and mental health variables. Finally, the interactions between independent self-construal and social support, and self-efficacy and mainstream acculturation were tested in the model. Additionally, the moderating effect of year of study was examined in post-hoc models if it was significantly related to the dependent variable. All interaction variables were centered prior to entering them into the model.

Because the dependent variable (LTPA) is measured in METs, the unstandardized beta values were used to determine a practical effect of the independent variables by calculating minutes of physical activity gained or lost in relation to the independent variable on one day by dividing the beta value by the MET quotient for the specific physical activity intensity. For

example, 100 METs of VPA would be divided by 8 to indicate 12.5 minutes of VPA could be gained/lost due to another an increase in one unit of the independent variable.

4.3. Results

4.3.1. Preliminary Analyses

Data were first analyzed for missing data, normality, outliers, and differences between age, sex, and BMI on the independent and dependent variables. For participants who reported days of physical activity but not minutes, or vice versa, the mean minutes or days for that activity type was inserted to calculate individual METs. Outlying scores ($z \geq 3.20$) were recalculated to be three standard deviations above or below the mean. No multivariate outliers were identified when examined using Mahalanobis distances. Data were found to be missing at maximum 11.8% for any variable and missing completely at random according to Little's MCAR test ($p > .05$). Skewness and kurtosis values along with visual inspection of the variable distributions indicated that MPA and walking were slightly skewed but did not warrant transformation.

Differences on independent self-construal were found for BMI such that those with a higher BMI reported more independent self-construals ($p < .05$). Participants were not different on age, or sex for any of the independent or dependent variables, and the effect of sex was null in the regression models. As a result, sex was not included in the models. Participants were different in age by year of study ($p < .05$).

4.3.2. Student Comparisons by Year

Model 1: LTPA. There was no effect of study year on the physical activity variables.

Model 2: SCT. Using Pillai's trace, there was a significant effect of study year on the SCT variables, $V = .07$, $F(8, 432.00) = 1.96$, $p = .05$. In particular, students were different by study year on perceptions of access to places to do physical activity, $F(2, 218) = 6.16$, $p = .002$.

Follow up univariate tests showed that senior students had significantly lower perceptions of access to places to do physical activity compared to first year (p = .05, 95% CI [-0.968 - -0.001], d = .38) and second year students (p = .003, 95% CI [-1.350 - -0.226], d = .62).

Model 3: Culture. There was no effect of study year on the culture variables.

Model 4: Mental health. Using Hotelling's trace, there was a moderate effect of study year on the mental health variables, T = .31, F(16, 420.00) = 4.04, p < .001. The groups differed on perceptions of discrimination (F(2, 218) = 9.77, p < .001), academic pressure (F(2, 218) = 3.04, p = .05), feelings of guilt towards their family (F(2, 218) = 3.58, p =.03), and general stress (F(2, 218) = 3.55, p = .03). Follow-up univariate tests showed that senior students rated themselves higher on discrimination compared to the first year (p <.001, 95% CI [0.356 – 1.230], d = .72) and second year students (p = .03, 95% CI [-0.040 – 1.056], d = .43). Second year students rated themselves lower on academic pressure compared to senior students (p = .05, 95% CI -1.336 - 0.003], d = .43). Senior students rated themselves higher on guilt towards their family compared to second year students (p = .04, 95% CI [0.0122 – 1.410], d = .44). Finally, first year students reported more general stress compared to second year students (p = .03, 95% CI [0.237 – 4.849], d = .45)

4.3.3. Relationships to Physical Activity

See Tables 4.3 – 4.5 for the results of the regression models for each type of physical activity. None of the interaction variables contributed significantly to the models, and are not reported in this section. Self-efficacy, intention, and exercise to reduce stress shared relationships with VPA. For every 1 unit increase in self-efficacy (on a 100 unit scale), participants did 1.6 more minutes of VPA. About 15 minutes of VPA was added for a 1-point increase in intention, and 19.17 minutes were added for a 1-point increase in perceptions that exercise can reduce

stress. Subjective well-being was the most important variable related to MPA, adding about 11 minutes of MPA per unit increase in well-being. Year of study, self-efficacy, and independent self-construal were related to walking. Walking decreased by about 45 minutes per study year increase. A univariate test showed that there was no difference in walking between first and second year students, but first year students walked significantly more than senior students (p = .043). Every unit increase in self-efficacy was related to about 2 minutes of walking, and an increase in independent self-construal added over an hour of walking.

Table 4.1.

Descriptive statistics by study year

Variable	First Year		Second Year		Senior	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
VPA	830.96 (1255.83)	0-4944	910.46 (1276.85)	0.4944	630.75 (1030.86)	0-3840
MPA	522.54 (667.43)	0-2906	504.43 (761.81)	0-2906	433.62 (649.61)	0-2906
Walking	1374.68 (913.16)	0.00-4158.0	1177.86 (1020.84)	0-4776	1014.82 (948.10)	0-4158
Self-efficacy	53.11 (24.43)	0-96.67	54.51 (20.06)	8.67-95.00	49.05 (24.33)	0-100
Intention	4.55 (1.91)	1-7	4.44 (1.93)	1.00-7.00	4.18 (1.97)	1.00-7.00
Social support	1.83 (1.83)	1.00-4.80	1.91 (0.90)	1.00-4.60	1.96 (0.96)	1.00-5.00
Perceived access	4.27 (1.31)^{b}	1.00-7.00	4.57 (1.43)^{b}	1.50-7.00	3.78 (1.31)^{a}	1.00-7.00
Chinese acculturation	6.77 (1.39)	1.60-9.00	6.91 (1.41	3.00-8.90	6.89 (1.11)	3.40-8.80
Mainstream acculturation	5.84 (1.07)	1.60-8.40	5.93 (1.12	3.20-8.00	5.80 (1.19)	1.70-8.40
Independent SC	3.51 (0.53)	1.67-4.89	3.53 (0.61)	2.00-5.00	3.56 (0.66)	1.78-5.00
Interdependent SC	4.10 (0.56)	2.29-5.00	3.88 (0.65)	2.00-5.00	4.04 (0.59)	2.71-5.00
Language insufficiency	3.49 (1.42)	1.00-7.00	3.17 (1.18)	1.20-5.60	3.17 (1.17)	0.91-6.27
Social isolation	3.06 (1.21)	1.22-7.00	3.29 (1.27)	1.00-6.50	3.46 (1.13)	1.00-5.88
Guilt Towards family	3.29 1.61)^{ab}	1.00-7.00	3.10 (1.66)^{b}	1.00-7.00	3.81 (1.63)^{a}	1.00-7.00
Discrimination	2.19 (1.04)^{b}	1.00-5.83	2.43 (1.39)^{b}	1.00-6.83	2.98 (1.17)^{a}	1.00-5.29
Academic pressure	3.61 (1.55)^{ab}	1.00-7.00	3.33 (1.52)^{b}	1.00-7.00	3.99 (1.57)^{a}	1.50-7.00
General stress	30.10 (5.93)^{a}	17.00-47.00	27.56 (5.58)^{b}	15.00-41.00	29.09 (5.32)^{ab}	17.00-42.00
SWB	7.92 (2.88)	-0.79-13.28	7.86 (2.74)	0.71-12.64	7.50 (2.30)	2.43-12.72
Exercise to cope with stress	4.32 (1.38)	1.00-6.00	4.10 (1.34)	1.00-6.00	4.14 (1.32)	1.00-6.00
Age	18.92 (1.20)^{a}	17-23	19.92 (1.06)^{b}	18-23	21.53 (1.62)^{c}	17-26
BMI	21.49 (3.33)	15.60-29.30	21.13 (3.22)	15.76-29.41	21.78 (4.10)	15.89-40.12

Note. VPA = vigorous intensity leisure time physical activity; MPA = moderate intensity leisure time physical activity; SC = self-construal; BMI= body mass index; SWB = subjective well-being; SD = standard deviation.

Different superscript letters indicate a significant difference between the groups $p < .05$.

Table 4.2.

Bivariate correlations for all participants

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1.VPA	1																						
2.MPA	.26[a]	1																					
3.Walking	.05	.25[a]	1																				
4.Self-efficacy	.46[a]	.24[a]	.26[a]	1																			
5.Intention	.45[a]	.18[a]	.20[a]	.70[a]	1																		
6.Social support	.20[a]	.18[a]	.04	.17[b]	.25[a]	1																	
7.Perceived access	.24[a]	.07	-.01	.25[a]	.29[a]	.15[b]	1																
8.Chinese acculturation	-.01	.05	.02	.06	.13	.09	.13	1															
9.Mainstream acculturation	.17[b]	.17[b]	.14[b]	.29[a]	.26[a]	.22[a]	.10	.20[a]	1														
10.Independent SC	.11	.15[b]	.18[a]	.16[b]	-.02	.12	.04	.07	.18[a]	1													
11.Interdependent SC	.14[b]	.14[b]	.15[b]	.13	.21[a]	.08	.13	.42[a]	.18[a]	-.06	1												
12.Language insufficiency	-.11	-.03	.04	-.16[b]	-.09	-.15[b]	-.11	.19[a]	-.30[a]	-.22[a]	.20[a]												
13.Social isolation	-.10	-.12	-.07	-.14[b]	-.22[a]	-.11	-.23[a]	.06	-.27[a]	-.12	.02	.58[a]	1										
14.Discrimination	-.10	.07	.09	-.07	-.07	-.02	-.32[a]	.02	-.06	.05	.00	.41[a]	.50[a]	1									
15.Academic pressure	-.10	-.08	.00	-.22[a]	-.24[a]	-.05	-.30[a]	-.02	-.14[b]	-.03	.03	.37[a]	.51[a]	.42[a]	1								
16.Guilt towards family	.00	.05	.09	-.09	.00	.14[b]	-.08	.27[a]	.03	-.01	.25[a]	.30[a]	.31[a]	.30[a]	.37[a]	1							
17.General stress	-.03	-.02	.09	-.04	-.04	-.04	-.19[a]	-.13	-.13[b]	-.06	.08	.38[a]	.39[a]	.34[a]	.56[a]	.22[a]	1						

18.SWB	.11	.21[a]	.08	.11	.08	.09	.18[b]	.22[a]	.15[b]	.27[a]	.08	-.15[b]	-.35[a]	-.19[a]	-.33[a]	-.04	-.49[a]	1					
19.Exercise to reduce stress	.36[a]	.23[a]	.09	.29[a]	.43[a]	.25[a]	.34[a]	.15[b]	.35[a]	.06	.23[a]	.03	-.05	.05	-.01	.19[a]	.03	.12	1				
20.Study year	-.07	-.08	-.18[b]	-.04	-.07	.04	-.17[b]	.03	.00	-.01	-.08	-.13	.14[b]	.28[a]	.11	.11	-.06	-.06	-.06	1			
21.Age	-.11	-.04	-.18[a]	.03	-.03	.01	-.12	.05	-.01	-.01	-.03	-.13	.15[b]	.16[b]	.11	.05	-.05	-.03	.00	.71[a]	1		
22.Sex	-.07	-.02	-.07	-.17[b]	-.06	.05	-.02	.04	-.05	-.07	-.13	.08	-.11	-.07	-.05	.14[b]	-.07	.11	.04	.01	-.09	1	
23.BMI	.07	.03	.05	.16[b]	.19[a]	.04	.12	-.05	.04	.20[a]	-.07	-.14[b]	.03	.06	-.01	-.08	.01	.02	.12	.03	.09	-.37[a]	1

Note. VPA = vigorous intensity leisure time physical activity; MPA = moderate intensity leisure time physical activity; SC = self-construal; BMI= body mass index; SWB = subjective well-being.

[a]$p < .01$; [b]$p < .05$.

Table 4.3.

Regression model summaries for vigorous physical activity

Step	Variable	B	SE B	β
1	(Constant)	900.34	167.23	
	Year of Study	-64.18	72.10	-0.06
2	(Constant)	-1070.69	312.24	
	Year of Study	-24.77	63.57	-0.02
	Self-efficacy	13.68	3.91	0.26**
	Intention	138.94	45.83	0.23**
	Social Support	112.82	77.61	0.09
	Access	84.43	53.51	0.10
3	(Constant)	-1497.72	672.55	
	Year of Study	-22.78	69.44	-0.02
	Self-efficacy	13.44	3.98	0.26**
	Intention	114.88	49.58	0.19*
	Social Support	72.08	80.09	0.06
	Access	40.83	58.49	0.05
	Exercise to reduce stress	149.74	59.77	0.18*
	Language difficulty	-64.65	72.11	-0.07
	Social isolation	55.87	81.63	0.06
	Discrimination	-70.61	72.69	-0.07
	Academic pressure	38.38	59.95	0.05
	Guilt towards family	-0.55	47.14	0.00
	General stress	2.34	16.41	0.01
	Subjective well-being	22.22	30.74	0.05
4	(Constant)	-1552.79	903.13	
	Year of Study	-10.77	69.77	-0.01
	Self-efficacy	13.05	4.06	0.25**
	Intention	121.97	50.37	0.21*
	Social Support	75.37	80.41	0.06
	Access	41.02	58.86	0.05
	Exercise to reduce stress	153.33	62.08	0.18*
	Language difficulty	-50.32	77.56	-0.06
	Social isolation	63.38	82.44	0.07

Discrimination	-79.58	74.01	-0.08
Academic pressure	34.21	59.93	0.05
Guilt towards family	8.69	48.70	0.01
General stress	-3.32	16.61	-0.02
Subjective well-being	20.35	32.08	0.05
Chinese Acculturation	-108.10	63.78	-0.12
Canadian Acculturation	-47.76	73.41	-0.04
Independent SC	127.59	125.66	0.07
Interdependent SC	169.04	133.39	0.09

Note. Step 1 $R^2 = .004$, Step 2 $\Delta R^2 = .26^{**}$, Step 3 $\Delta R^2 = .03$, Step 4 $\Delta R^2 = .02$.

$^{*}p < .05$, $^{**}p < .01$.

Table 4.4.

Regression model summaries for moderate physical activity

Step	Variable	B	SE B	β
1	(Constant)	575.37	93.10	
	Year of Study	-48.27	40.14	-0.08
2	(Constant)	86.84	195.21	
	Year of Study	-48.09	39.75	-0.08
	Self-efficacy	4.97	2.45	0.17*
	Intention	11.06	28.65	0.03
	Social Support	105.49	48.52	0.15*
	Access	-4.62	33.45	-0.01
3	(Constant)	-560.22	412.84	
	Year of Study	-53.06	42.62	-0.09
	Self-efficacy	4.81	2.44	0.17*
	Intention	-15.13	30.43	-0.05
	Social Support	78.34	49.16	0.11
	Access	-18.71	35.91	-0.04
	Exercise to reduce stress	69.12	36.69	0.15
	Language difficulty	-6.81	44.27	-0.01
	Social isolation	-48.63	50.11	-0.09
	Discrimination	77.74	44.62	0.15
	Academic pressure	-25.02	36.80	-0.06
	Guilt towards family	9.23	28.94	0.02
	General stress	10.05	10.08	0.09
	Subjective well-being	45.44	18.87	0.19*
4	(Constant)	-861.77	558.36	
	Year of Study	-49.16	43.14	-0.08
	Self-efficacy	4.51	2.51	0.15
	Intention	-14.87	31.14	-0.05
	Social Support	77.35	49.71	0.11
	Access	-19.23	36.39	-0.04
	Exercise to reduce stress	64.04	38.38	0.13

Language difficulty	-4.92	47.95	-0.01
Social isolation	-42.81	50.97	-0.08
Discrimination	76.18	45.75	0.14
Academic pressure	-26.26	37.05	-0.06
Guilt towards family	6.22	30.11	0.02
General stress	8.34	10.27	0.07
Subjective well-being	43.06	19.83	0.18*
Chinese Acculturation	-24.11	39.43	-0.05
Canadian Acculturation	3.12	45.39	0.01
Independent SC	42.79	77.69	0.04
Interdependent SC	97.14	82.47	0.09

Note. Step 1 $R^2 = .01$, Step 2 $\Delta R^2 = .07^{**}$, Step 3 $\Delta R^2 = .07^{*}$, Step 4 $\Delta R^2 = .01$.

$^{*}p < .05$, $^{**}p < .01$.

Table 4.5.

Regression model summaries for walking

Step	Variable	B	SE B	β
1	(Constant)	1501.02	131.84	
	Year of Study	-150.53	56.84	-0.18**
2	(Constant)	1193.63	276.23	
	Year of Study	-155.06	56.24	-0.18**
	Self-efficacy	8.23	3.46	0.20*
	Intention	45.32	40.54	0.10
	Social Support	4.12	68.66	0.00
	Access	-76.60	47.33	-0.11
3	(Constant)	434.36	594.15	
	Year of Study	-167.30	61.34	-0.20**
	Self-efficacy	8.88	3.52	0.21*
	Intention	33.20	43.80	0.07
	Social Support	-22.56	70.76	-0.02
	Access	-53.13	51.68	-0.08
	Exercise to reduce stress	-9.51	52.80	-0.01
	Language difficulty	12.50	63.71	0.02
	Social isolation	-104.51	72.12	-0.14
	Discrimination	97.39	64.22	0.13
	Academic pressure	13.00	52.96	0.02
	Guilt towards family	61.69	41.64	0.11
	General stress	12.31	14.50	0.07
	Subjective well-being	29.88	27.15	0.09
4	(Constant)	-650.57	793.26	
	Year of Study	-151.35	61.29	-0.18*
	Self-efficacy	7.25	3.57	0.17*
	Intention	43.82	44.24	0.09
	Social Support	-33.86	70.62	-0.03
	Access	-51.45	51.70	-0.07
	Exercise to reduce stress	-29.91	54.53	-0.04
	Language difficulty	47.76	68.12	0.07
	Social isolation	-86.88	72.41	-0.11

Discrimination	76.89	65.00	0.10
Academic pressure	7.11	52.64	0.01
Guilt towards family	58.08	42.78	0.10
General stress	7.30	14.59	0.04
Subjective well-being	16.92	28.18	0.05
Chinese Acculturation	-62.72	56.02	-0.09
Canadian Acculturation	47.88	64.48	0.06
Independent SC	221.86	110.37	0.14*
Interdependent SC	177.29	117.16	0.11

Note. Step 1 $R^2 = .03^{**}$, Step 2 $\Delta R^2 = .07^{**}$, Step 3 $\Delta R^2 = .04$, Step 4 $\Delta R^2 = .03$.

$^{*}p < .05$, $^{**}p < .01$.

4.4. Discussion

This research aimed to describe how social cognitive and mental health correlates of physical activity differed over time for Chinese international students in Canada by comparing a sample of first year, second year, and senior undergraduate students. This design provided insight into how health behaviour and behavioural correlates can change over time for a unique student group. Trends in acculturation and self-construal and their role in LTPA were also examined. Senior students appeared to have a unique experience from the second year and first year students. Senior students perceived fewer places to do physical activity, and experienced more discrimination compared to the first and second year students. Senior students experienced more guilt towards their family and academic pressure compared to the second year students. The initial transition to Canada appears to induce more general stress as first year students reported more stress compared to second year students. This latter finding supports work by Ward and Kennedy (1999) who indicated that initial transitions were the most difficult for international students. These trends may help identify times during a Chinese international student's degree that are critical for intervention.

No differences were found for the culture variables between the study years as anticipated. Some research with immigrants suggested that more acculturation was related to more physical activity (Guo & Ross, 2014), but in our sample, year of study was negatively related to walking. These findings contrast with qualitative research which suggested that international student physical activity may improve as they spend more time in their host country (Z. Yan & FitzPatrick, 2016). There were no differences, however, between student groups in this study on acculturation. Regardless of self-construal, first year students tend to have more diversity in their classes and would therefore be required to walk to more areas of campus to the

locations of these departments. The narrowing of course topics taken in senior years may reduce this need to travel around campus.

Interestingly, more similarity to mainstream culture (i.e., independent self-construal) was related to more walking. Year of study may not be linked to endorsement of an independent self-construal for these students, but regardless of how they may develop this self-construal it may be related to their walking behaviour. In a study of East Asians in Germany, those who were assimilated or integrated into the host culture were characterized by high independent self-construal, and those who were assimilated had fewer depressive symptoms relative to the other groups (Shim, Freund, Stopsack, Kämmerer, & Barnow, 2014). As such, independent self-construal may act as an indicator of similarity to Canadian culture, but this should be tested with a representative sample. More independent students may feel more comfortable in the community and the larger cultural climate and because of this they may be more likely to participate in activities on campus or with friends.

Of the SCT variables self-efficacy was expected to share the largest relationship with physical activity based on previous research demonstrating large effects of self-efficacy over other social cognitive and environmental factors (Ayotte et al., 2010; McNeill, Wyrwich, Brownson, Clark, & Kreuter, 2006; Rovniak et al., 2002). For VPA and walking, self-efficacy may be important targets for all the student groups. In addition, VPA was higher with more intention to be physically active and a belief in physical activity to cope with stress. Intention could be considered a self-regulatory mechanism; it implies planning and behaviour management (Karoly, 1993; Luszczynska & Schwarzer, 2005). In a sample of first year college students in the United States (international student status was not identified), self-efficacy and challenging physical activity goals were related to more VPA (Doerksen et al., 2009). Improving self-

efficacy may be enough to promote walking among Chinese international students, and it may be particularly important in later years of study. For more vigorous activities, a combination of intention or goal setting and self-efficacy may be targeted for improving this behaviour. Self-efficacy could help improve perceptions of access to places to do physical activity, and this may be important for senior students. Access perceptions are hypothesized to improve intentions to do physical activity (Bandura, 2004), and perceptions of decreased access could hinder participation especially in the more senior students.

In addition to self-efficacy, we expected that social support would be related to physical activity in the present sample, possibly in those with independent self-construals because of the social benefits of physical activity for international students especially in campus sport and intramural settings (Gómez et al., 2014; Stodolska & Alexandris, 2004). It is possible that the students at the beginning of their studies did not want to burden their friend group with new activities (Hudson et al., 2013), or they were too concerned with adjusting to Canada and the academic load to recruit friends with whom to be physically active. Social support was not different by study year indicating that novelty or adjustment are likely not the only reasons for the null effect of social support on physical activity. It is possible that social support was indirectly related to physical activity as this relationship has been previously identified (Rovniak et al., 2002; Taymoori et al., 2010). Social support was noted by Bandura as a mechanism for self-regulation, and to increase self-efficacy (Bandura, 1997), and as such it may have played a role in the relationship between intention, self-efficacy and VPA. Future studies should use modelling techniques to identify these indirect relationships.

Asian international students may not recognize the benefits of LTPA for supporting social interaction, more often recognizing physical benefits of physical activity (Guo & Ross,

2014). Social isolation has been linked to language insufficiency which may make students feel uncomfortable interacting with others in a physical activity setting (McLachlan & Justice, 2009; Yeh & Inose, 2003). Language insufficiency was correlated with almost all the other acculturative stress subscales in this study, showing that it can contribute to various types of stress for undergraduate students. Social relationships and facilitators of these relationships (i.e., language training, integration events) should be fostered in university environments. Furthermore, other acculturative stress components may combine to determine the LTPA of Chinese international students, and these should be addressed as a group of potential stressors.

Students feeling stressed because of their studies or transitions may recognize the benefits of being physically active. Motivation to exercise to reduce stress was related to VPA, and subjective well-being was related to more MPA. It is likely that the relationship between subjective well-being and MPA is reciprocal. In a study on Asian international student campus recreational sport participation, releasing stress and pressure was the second highest rated reason to participate in recreational sport after fitness benefits (Guo & Ross, 2014). For Chinese students in Canada reducing stress related to academics as well as cross-cultural transitions was an important reason to be physically active (Brunette et al., 2011). Sport or exercise for stress reduction should focus on activities that induce physiological responses (e.g., social outings, dancing, yoga, walking) because students can then identify the bodily sensations of stress and employ these strategies to minimize stress responses (Gómez et al., 2014). First year students may experience a large amount of stress compared to the older students, while senior students may be particularly concerned about their academic success, feelings of guilt towards their family, and experiences related to discrimination. Creating opportunities to relieve stress and

improve student well-being through physical activities of varying intensities should be a priority on campuses.

The types of stressors experienced by Chinese international students may be different depending on their stage of study, and length of stay in Canada. These factors should be considered when developing programs to help international students adapt and cope with stress as they continue their studies. For instance, not only did the senior students experience more guilt related to their families and academic stress, they also perceived more discrimination compared to students in earlier years. International students in the United States who lived in the host country longer experienced more discrimination (Poyrazli & Lopez, 2007). This was explained by culture shock theory which describes that after a period of initial fascination and excitement, more negative aspects of living in the host culture are observed. There may also be an increase in understanding of verbal discrimination with improving language skills.

Research has also shown that integration with the host culture could result in fewer experiences of discrimination (Berry & Sabatier, 2010). There were no differences in acculturation between the student groups in this study. Encouraging integration with Canadian culture may help to diminish experiences of discrimination. Experiencing discrimination could discourage orientation to the host culture, however, making such a solution unlikely to be pursued (Berry & Sam, 2006). Students could also learn effective coping strategies such as problem-focused coping including personal confrontation, taking formal actions, and support seeking which were found to reduce the distressing influence of discrimination for Koreans in Canada (Noh & Kaspar, 2003). Emotion-focused coping (i.e., passive acceptance, emotional distraction) may also be effective, but only if a person feels supported in their cultural community (Noh & Kaspar). If discrimination cannot be removed at the personal, community, or

institutional level, international students should be equipped with coping strategies and connected with campus services and mentors to help in language learning and stress reduction (Frey & Roysircar, 2006). Institutions could implement education campaigns about recognizing and avoiding discrimination (Poyrazli & Lopez, 2007). These campaigns should target staff, domestic and international students to identify what discrimination means in different contexts and how it can be mitigated. Implementing these programs early in an international student's experience could help build resilience and allow students to focus on academic and personal growth.

4.4.1. Limitations

The design implemented in this study is limited due to potential differences that were not measured between the student groups. Some of the measures may not have captured the concepts intended. The self-efficacy measure may have been too specific to exercise participation rather than physical activity more generally. Self-reported physical activity may also be inaccurate due to participant recall errors or inaccuracy in reporting. The intention measure may not be fully representative of goal setting or self-regulation and is limited by examining intention to do future behaviour cross-sectionally.

4.5. Conclusions

This study showed that Chinese international students may perceive their environment differently, and experience different kinds of stress as they advance in their academic years. Walking behaviour may also decline over time for these students. Developing self-efficacy and self-regulation strategies for health behaviours early in the post-secondary journey may be important to maintain these positive behaviours, especially when balancing them with academic and other commitments. Chinese international students who are active likely understand the

stress relieving benefits of physical activity, but they might benefit from experiencing the social benefits as well. Practitioners should organize physical activity programming with year of study and cultural factors in mind.

Chapter 5: General Discussion

International students are in a unique period in their lives in which there are ample opportunities for learning academically, socially, and behaviourally. Students may choose several strategies to adjust to and engage with the host culture, and these strategies may change over time. Adjustment may be more difficult if the international student's culture is less similar to their host culture (Z. Yan & FitzPatrick, 2016), necessitating more nuanced programming and support for international student groups. The physical and mental health benefits of physical activity are well known, and for international students these benefits could extend to adjustment and reduction of acculturative stress associated with adjustment. Physical activity could also be a tool for institutions to create hospitable environments. Before implementing programming for international students, a better understanding of what determines their physical activity participation and what outcomes they obtain from physical activity is needed. Additionally, these determinants and outcomes could change over time and interact with culture and acculturation as students spend more time in the host culture.

Mainland Chinese international students were chosen for this dissertation project because Chinese international students are the largest international student group at the University of Alberta, and their home culture is typically very different from Western culture. I selected social cognitive theory as the guiding behavioural theory because of its utility in diverse cultural settings, and because the constructs can be purposefully targeted for change in intervention settings (Bandura, 1986a, 2004). Mental health outcomes of interest were stress, acculturative stress, and subjective well-being. General stress was assessed because students often experience stress related to academics, relationships, or daily life and physical activity has been shown to reduce stress and improve well-being (Mikkelsen et al., 2017). In addition, a distinction between

general stress and clinical symptoms was not a priority for this research project. Acculturative stress is a unique type of stressor for international students, and this complex type of stress could help in understanding the experiences of Chinese students in Canada.

The inclusion of variables that measure culture and cultural change in relation to physical activity were a unique addition to this research and were incorporated because it is not sufficient to assume that people will act or think in a certain way based on their geographic origins. These culture variables represent personal characteristics that may change over time with increased exposure to the host culture (Landrine & Klonoff, 2004). Behavioural and cognitive changes over time were examined by comparing first year students at two time-points. A better conception of these changes may contribute to more effective and targeted programming to support the health and wellbeing of Chinese international students.

5.1. Summary of Study One

Study one had three main purposes. Foremost, it was designed to test the factorial validity and reliability of the survey instruments translated into simplified Chinese. I decided to translate the instruments despite them being used with international students who would be studying in English because language can influence response styles, cause variance across cultures on the same measure (Harzing, 2005, 2006), and alter perceptions of confidence (S. X. Chen, Lam, Buchtel, & Bond, 2014). In addition, the students in Canada would be sampled for studies two and three in their first months at the University of Alberta and offering them an easily understood survey could decrease participant burden. The second purpose of study one was to investigate the SCT variables and mental health variables in relation to physical activity in a Chinese sample. Third, direct exposure to Chinese student culture and broader culture as an international researcher allowed experiential learning and observation of study concepts in action.

During translation, several discussions took place around the meaning of the survey items. Particularly, the choice of describing physical activity as opposed to exercise was made to generate a broader conception of the behaviour. Additionally, adjustments were made to increase their relevance to the Chinese students' lifestyle (i.e., removal of gardening examples as the students likely do not have the opportunity to do this activity). Through translation and the exploratory factor analyses, the instruments were streamlined and refined to capture meaningful responses from participants. The test-retest results indicated that some of the measures may represent constructs that are more variant or trait-like. The modified questionnaires were used for the remainder of the analyses in studies one to three.

After the instruments' structure and reliability was examined, two structural equation models were tested. The first model aimed to test Bandura's (1986) Social Cognitive Theory (SCT) predicting health behaviour. This theory was chosen because it accounts for the personal, environmental, and behavioural interrelationships involved in making choices about health behaviour. In addition, Bandura proposed theoretical constructs that can be targeted and altered to promote health behaviour (Bandura, 1998, 2004). For example, the central construct of self-efficacy can be improved through experiencing success, verbal/social persuasion, vicarious experience, or their interpretation of somatic and emotional states (Bandura, 1998). For this research program, SCT is useful because of its cross-cultural transferability. The agentic perspective of SCT assumes that one can influence their functioning and life circumstance intentionally (Bandura, 1986a). People can be personal agents, agents on behalf of another, or work towards collective goals. The blend of these three types of agency can vary by culture. Regardless of culture, the most pervasive mechanism of human agency is self-efficacy (Bandura,

1997). This is because even if goals are collective, personal capabilities must be mobilized to achieve these outcomes (Bandura, 2002).

In addition to self-efficacy, the components of SCT tested in this model and studies two and three of this research project included social support, proximal goals (i.e., intention), and access to places to be physically active. Social support was proposed by Bandura to bolster self-efficacy, and is therefore presumed to be indirectly related to behaviour (Bandura, 2002, 2004). Proximal goals were included as a measure of self-regulation, and are proposed to be influenced by self-efficacy, and directly influence behaviour. Sociostructural facilitators are not often included when testing SCT models (e.g., Anderson, Wojcik, Winett, & Williams, 2006; Rovniak, Anderson, Winett, & Stephens, 2002). In our model, the indirect impact of perceived access to places to do physical activity through proximal goals (intention) was included as a measure of facilitators/ barriers to physical activity as described by Bandura (1998, 2004).

The structural model of SCT in relation to MPA and VPA in the Chinese student sample showed social support as the only direct predictor of VPA. Self-efficacy was related to intentions, and perceptions of access. The social support relationship may be most relevant for those with an independent self-construal because they may be more willing to ask their friends for support in their activities (S. E. Taylor et al., 2004). The more interdependent students may perceive help seeking as interrupting social harmony and resist this type of support for physical activity behaviour. The lack of relationship between intention and behaviour exemplifies the intention behaviour ‘gap’ in this population, and they could benefit from planning and self-regulation strategies. These results suggest that social support should be leveraged among Chinese university students to promote physical activity. Despite the transferability of SCT

across cultures, the manifestation of the constructs for supporting health behaviour may vary by culture and should be examined in diverse cultures to verify the structure.

The second structural model developed using the sample of Chinese students examined VPA and MPA in relation to stress and SWB. Stress is a large component of university studies, and strategies to mitigate the negative effects of stress such as physical activity should be promoted among students (Gerber, Kalak, et al., 2012). In addition, supporting positive emotions and well-being can improve overall quality of life and reinforce physical activity behaviour. There is little consensus on the best intensity of physical activity for mental health benefits, and these may also differ by culture and age. In the final model, physical activity was negatively related to stress, and positively related to SWB as expected. The only significant relationship was between MPA and stress. The affective preferences of Chinese students may be a reason that MPA was related to stress reduction because research has shown they prefer more low arousal positive states which may lead them to choose less intense activities for stress reduction (J. L. Tsai, 2007). One reason SWB may be less important as an outcome of physical activity is due to perceptions of emotion in East Asian cultures. In North America, happiness is an individual pursuit, while East Asians tend to have lower self-enhancement and refer to relational norms of emotion. Taoist and Buddhist perspectives which emphasize harmony and the power of the mind may also influence ratings of happiness or life satisfaction (Lu, 2010). The conceptualization of SWB as an outcome of physical activity may need to be revised in a Chinese population to be less broad, and more consistent with cultural conceptions of happiness and well-being. Overall, this study offers insight into the mental health benefits of physical activity for Chinese students and provides evidence for promoting the behaviour as a tool during stressful times.

5.2. Summary of Study Two

Researchers identified that adjustment to their new environment is the most difficult at the beginning an international student's time in the host country (Ward & Kennedy, 1999). However, researchers studying acculturation suggested that adaptation follows a U-shape beginning with more positive mental health at the beginning of their adaptation, meeting problems over time and eventually resolving these issues (Zheng & Berry, 1991). Stress and mental health patterns have not been examined over time for Chinese international students in Canada. Physical activity may help students to adjust to their host culture through socialization, and some researchers found that international students did more physical activity over time in the United States (S. Li & Zizzi, 2017). Identifying changes in mental health, acculturation, physical activity, and social cognitive predictors of physical activity over time could help identify patterns that occur over the first year of study for Chinese international students. Data were collected at two time-points (fall and spring) using the same questionnaire translated in study one with the addition of acculturation and acculturative stress scales.

There was a high attrition rate for part two of the study, and the sample for study two was much lower than proposed (n = 22). Please see the discussion on recruitment in the limitations section (5.7) for commentary on recruitment. Because of the small sample, correlations between time points were interpreted in addition to the repeated measures analyses. The only variable that changed over time was stress, which increased from time one to time two. This result may support the U-shape hypothesis of adjustment, but it is not clear when students might return to lower levels of stress. Notably, the physical activity variables were not correlated over time, which indicates inconsistency in physical activity participation. It is also possible that self-report measurement of physical activity is not reliable over time. Moreover, acculturation was not

correlated over time, which could mean that the time between measures was not long enough to see changes in student acculturation.

Academic pressure at time 1 and stress at both time points were correlated, which could indicate that students were experiencing stress related to academics at time 2. Students might benefit from time management strategies to help manage demands of the university environment. Intention seemed to be the most important SCT variable for physical activity as it was related to MPA, walking and self-efficacy at time 1. In addition, social support for physical activity at time 1 was related to VPA and intention at time 2. Social benefits of physical activity for international students are repeatedly shown in the literature, and should be a focus for health behaviour promoters (Berry, 1997; Sawir et al., 2007; Schartner & Young, 2016). Given these results surrounding social support, it is not surprising that social isolation (time 1 and 2) was related to language insufficiency, academic pressure, and subjective well-being (negative) at both time points, and stress at time 2. Improved language skills can help students engage in classroom and social settings and should be a priority for international students. Finally, several variables shared unexpected relationships with discrimination including VPA and MPA, and exercise to cope with stress. Stress and discrimination were positively correlated as expected. Students may use physical activity to cope with discrimination, but they may also alter their physical activity settings to avoid negative experiences. It is encouraging that students associated exercise with reducing stress potentially resulting from discrimination. Discrimination is a problem for many Chinese international students in Canada (Houshmand et al., 2014), and the negative effects should be recognized. Students and institutions should implement positive coping strategies such as help seeking from peers or informing managers and leaders of mistreatment.

Although the sample size of this research was not large enough to draw strong conclusions, this study offers insight into patterns of physical activity behaviour and psychological variables related to this behaviour. Patterns of student needs should be integrated into programming, and students could use this information to understand their own international journey.

5.3. Summary of Study Three

In the final study of this dissertation I examined differences between a sample of first year, second year and senior (third to fifth year) Chinese international students on the same SCT, mental health, and culture variables that were used in the first two studies. In correspondence with study two, patterns of behaviour and behavioural correlates over time can help recreation programmers and students to anticipate and adapt to the changing needs of Chinese international students. Of interest in this study were the potential relationships of the culture variables (acculturation, self-construal) and physical activity in addition to the mental health and SCT variables which have shown relationships with physical activity in past research. Pinpointing the amount of variance that culture can have on behaviour is extremely relevant for acculturating groups because these factors may help explain health behaviour beyond what is typically measured in behaviour change models.

Senior students in this study perceived fewer places to do physical activity, and more discrimination compared to first and second year students. Senior students also reported more academic pressure and guilt towards their family compared to second year students. First year students had higher general stress compared to second year students. Self-efficacy was positively related to VPA and walking for all students. More intention and motivation to exercise to reduce

stress were related to VPA. Subjective well-being was related to MPA. Walking was negatively related to study year, and positively related to independent self-construal.

Unexpectedly, the students did less walking as they advanced in their studies, but independent self-construal was positively related to walking. The results support research suggesting that more acculturation or similarity to the host culture is related to more physical activity (Z. Yan & FitzPatrick, 2016). Time in a Canadian university may not be related to independent self-construal development, but self-construal may be an important factor in walking behaviour.

Like study two, intention appeared to be an important SCT construct for VPA. Self-regulation through proximal goals may be more relevant for Chinese international students in conjunction with self-efficacy for vigorous intensity physical activity. Self-efficacy was also relevant for walking behaviour and may become even more important over time if more senior students are walking less. Senior students who do not recognize places to do physical activity may benefit from enhancing their self-efficacy to seek out physical activity opportunities.

Students who recognized that exercise could be used to cope with stress did more VPA in this sample. Subjective well-being was also related to MPA, suggesting that mental health may share reciprocal relationships with physical activity. Senior students experienced more acculturative stress related to academic pressure, discrimination and guilt towards their family compared to first year and/ or second year students. First year students, however, were more stressed than their second year colleagues. These trends could help inform the development of stress management programs for international students as their needs change.

This study allowed insight into how international students may change as they spend more time in Canada. While there may have been differences between the samples that were not

measured, the changes that occur over time are worth considering for programmers and international students alike.

5.4. Summary of Results

All together the three studies that comprise this dissertation project show patterns of behaviour and cognition worth noting. For students in China, vigorous physical activity may be best supported by social support, while Chinese students in Canada may not use social support as a resource to enhance their physical activity, potentially due to having a smaller social network. It could be that international students are dealing with a unique source of acculturative stress in addition to academic stress. Stress was an important thread of discussion throughout this project. Both groups of students appear to use physical activity to reduce stress. In the Chinese students, moderate intensity physical activity was related to stress reduction, while international students understood the benefits of physical activity in stress reduction, and those who did moderate physical activity appeared to have more SWB. The changes in stress over time (increasing in first year and then possibly decreasing by second year) may or may not be unique to the international students, but these patterns have not been examined in domestic Chinese students.

Another important stressor for students was discrimination. In study two, discrimination was positively related to physical activity, and in study three senior students reported experiencing more discrimination. Discrimination can have important implications for mental health (D. R. Williams, Neighbors, & Jackson, 2003) and although it was positively related to physical activity in study two, it was also negatively related to SWB, and perceptions of discrimination appear to increase over time in Canada for the international students in study three. These results have implications for university programming and international student coping mechanisms.

Acculturation and self-construal were measured in international students, and self-construal was measured for non-international Chinese students. Although acculturation to Canadian culture was expected to promote physical activity, this result was not found. Independent self-construal, however, may lead to more walking in Chinese international students regardless of year of study. We speculated that more independent Chinese students would be more likely to seek social support for physical activity in the sample from China, but this hypothesis could not be tested.

For all the student groups in Canada, self-efficacy and self-regulation or goal setting could be important facilitators of physical activity. For the non-international Chinese students, social support overrode the effect of self-efficacy in the SCT model, and intention was not related to behaviour. These two constructs have shown consistent links to behaviour and could be leveraged alongside social support for physical activity promotion in this group. In the international students, self-efficacy and intention were linked with behaviour over time in the first year students, and in the regression models examining all the international students. While international students are indeed dealing with acculturative stress including language, missing home, academic pressure, and discrimination it is likely that the social cognitive targets could help promote physical activity in either group.

5.5. Implications

Students undergoing any type of transition are likely to experience some degree of distress throughout the transitional period (Jones, 2017). This type of stress is unavoidable, and likely aids adjustment through self-discovery and learning to cope compared to someone experiencing no stress (Chrousos & Gold, 1992). The adverse effects of stress, however, are impossible to ignore (Thoits, 2010). Throughout this dissertation project, implications on how to

mitigate this stress and potentially improve psychological outcomes for Chinese international students through physical activity were identified with consideration for their cultural background and how it may influence behaviour and change over time.

Social cognitive theory was first examined because it can be used to describe correlates of physical activity but also provides recommendations to improve the behaviour in practice. For the international students in this research and likely non-international students, physical activity routines, goal setting, and improving self-efficacy would help maintain the behaviour. For the international students in Canada social support may not be fully recognized as a way to improve physical activity. Social support and self-construal may share unique relationships for Chinese international students.

Some research has suggested that those who endorse interdependent self-construals may be less likely to seek support in times of stress so as to maintain social harmony (S. E. Taylor et al., 2004). In the present research, independent self-construal was related to walking for all years of study. This cognitive pattern may, therefore, be an indicator of higher physical activity participation and those who are less independent may require more support. Less interdependent older adults from Hong Kong who did more exercise rated themselves higher on relatedness satisfaction, while those who were more interdependent showed an opposite pattern (Poon & Fung, 2008). This research may indicate that those who are more interdependent may not engage in physical activity for social benefits or use it to engage socially. Encouraging recognition of the social benefits of physical activity and limiting social risks in participating could promote physical activity involvement on campuses for international students especially if they are more interdependent. Previous research and our data are not clear on how culturally based cognitive

patterns such as self-construal and acculturation may change over time, but understanding these changes could help in supporting international students at different stages of their acculturation.

The first year students in our sample did not show evidence of acculturation over their first year of study, and there were no differences between first, second, and senior students. Acculturation and integration into the host culture can improve mental health including depressive symptoms (Shim et al., 2014), and well-being (J. Li, Liu, Wei, & Lan, 2013) compared to disengaging from the host culture. Relationships between physical activity and acculturation are likely bidirectional; physical activity could improve acculturation by providing opportunities for socialization with members of the host culture, or more acculturation could make international students more likely to engage in physical activity in their new cultural setting (Brunette et al., 2011; S. Li & Zizzi, 2017; Z. Yan & FitzPatrick, 2016). Students may not be interested in participating in the host culture if they are planning to return to their home country. In our sample, those who were more acculturated to Chinese culture were more likely to intend to return to China ($r = .40$, $p < .01$) after their studies and those who were more acculturated to Canadian culture did not intend to return to China ($r = -.19$, $p < .05$). Opposite patterns were found for intention to stay in Canada. International student's future plans could be a good indicator of their motivation to engage with the host culture. Students who intend to return to China may need to be informed on the benefits of interacting with the host culture and given opportunities to engage in meaningful ways. In addition to the psychological correlates of physical activity, the outcomes of this participation were of interest in this research.

With the Chinese students, MPA was related to less general stress, and possibly better SWB. The first year international students in this study reported an increase in their stress from time 1 to time 2 (3-6 months apart), and second year students reported less stress than first year

students. These findings may show support for the U-shape hypothesis of acculturative stress where the initial honeymoon period after moving is followed by a decline in mental health, then increasing after an adjustment period (Zheng & Berry 1991). This adjustment period may involve more academic and social growth, and more developmental competencies (i.e., resilience, social competence, self-efficacy; Shek et al., 2017). Development and engagement is likely accomplished through a combination of effort by the institution to provide programming and the student to identify and take part in such programs (Bai, 2016b). Institutions could intervene during times of high stress or poor mental health to provide programs and initiatives to help students cope and recover during these times and develop skills they can use throughout their degree.

In the current project, general stress and acculturative stress were distinguished because there can be unique stressors related to acculturation impacting the adaptation of international students. Indeed, cultural distance or dissimilarity between Chinese and Canadian culture can mean more acculturative stress and reduced ability to communicate between cultures on multiple levels (Arthur, 2017; K. Yan & Berliner, 2011; Zhou, Zhang, & Stodolska, 2017). Again, participation in the local university community could help mitigate this type of stress by reducing social isolation (Berry, Kim, Minde, & Mok, 1987). Furthermore, acculturative stress may result in worse psychological outcomes for those who are less acculturated to the host culture (Zhou et al., 2017). The positive relationships between social support and physical activity in studies one and two could indicate an important area of intervention as social interaction has been recommended as an important way to improve adjustment experiences (Arthur, 2017; Lértora, Sullivan, & Croffie, 2017; Z. Yan & Sendall, 2016). Intercultural friendship may also help to bridge some existing cultural gaps, but research shows that international students are more likely

to make friends with others from their home countries. Some of the reasons for this are that Chinese students may not know what to talk about with host nationals. They may also be unmotivated because they are sojourners, unfamiliar with social norms, lack socialization opportunities, or have difficulty in balancing social networks with host and co-nationals (Zhou et al., 2017). On the other hand, host nationals may not be motivated to make friends with international students because they have already established friend groups, they may be less motivated to seek out friendships with international students, and academic competition may result in ignoring international students in discussions or group work (Arthur, 2017). International and domestic students could both benefit from interacting with one another, but domestic students may need to learn these benefits and low risk opportunities to engage socially should be provided (Arthur, 2017). Although cultural distance will always be a barrier to intercultural connection, recreation such as physical activity could be an avenue to cultivate these friendships (Glass, Gómez, & Urzua, 2014). Universities could facilitate these interactions further through conversation clubs, leadership initiatives, and social activities designed to promote intercultural interaction.

Some changes in patterns of acculturative stress were identified in the research with Chinese international students in Canada (i.e., senior students experienced more discrimination and guilt towards their family, and academic pressure compared to first and/ or second year students). It is understandable that sources of this stress may change over time from issues like language to academics, citizenship and career, and self-identity (Zhou et al., 2017). Academic stress may be one reason that students do not engage in physical activity despite their apparent awareness of the utility of this behaviour in stress reduction. Students likely feel immense pressure to perform academically, leaving little time for recreation outside of school work (Guo

& Ross, 2014; Hashim, 2012; McLachlan & Justice, 2009). In one study, more Asian students prioritized academic activities over recreational activities compared to other international students (M. Z. Li & Stodolska, 2006). Students who attend an international school may view it solely as an opportunity to improve their career opportunities upon return to their home country. As such, their temporary status may limit their motivation to dedicate time to leisure activities like physical activity (M. Z. Li & Stodolska, 2006). In a systematic review on goals and physical activity, academic goals were less likely to be negatively related to physical activity compared to leisure time sedentary behaviour goals (Rhodes, Quinlan, & Mistry, 2016). Although the study included mostly students (international status unknown), only 4% of the included research was from Asia. The authors suggested that more prevalent behaviours should be targets for addressing goal conflict. As such, for an international student population, it is likely that academic goals conflict strongly with physical activity goals.

Acculturative stress related to discrimination in this research has important implications for Chinese international students. Importantly, perceived racial discrimination is related to several mental health problems like anxiety, depression psychological distress, and suicidal ideation (Hwang & Goto, 2009) and poorer psychological and sociocultural adaptation (Berry & Sam, 2006). While students may still find ways to be physically active, they may simply be adjusting their behavioural strategies rather than developing coping strategies or benefitting from efforts by the university community to reduce discrimination in recreation settings. Canadians take great pride in their acceptance of diversity and multicultural identity (Cameron & Berry, 2008). This pride appears to be beneficial for people who may wish to maintain ties with their ethnic group, but there is some evidence that integrating with the host culture may reduce discrimination experiences (Berry & Sam, 2006). Other research found that problem-focused

coping could be beneficial for those who are more comfortable in the host cultural setting, and emotion focused coping may be appropriate if a person feels supported by their cultural community (Noh & Kaspar, 2003). Feelings of guilt toward family for the senior students in our international student sample may exacerbate the negative effects of discrimination felt by students if family is a source of support. Efforts by institutions to attend to the types and nuances of discrimination experienced on campus in addition to providing coping resources should be coupled with individual coping efforts to manage discrimination faced by international students.

5.5.1. Future Directions

Expanding this research to other international student groups could help determine the types of interventions that would be useful for many groups. This could help create effective targets for institutions that are relevant to multiple student groups. The relationships between stress such as discrimination and physical activity over time are also valuable to disentangle including the sources of this stress. Interventions related to university policy in addition to interventions targeting student coping may combine to generate multilevel impacts on international student mental health. For example, institutions could implement staff training and evaluate current physical activity dissemination for potentially discriminatory practices. An intervention integrating education on physical activity benefits and stress reduction, encouragement of social support, and development of social cognitive skills for physical activity may help international students to reduce their stress and develop physical activity habits. To better examine the role of physical activity in mental health outcomes for Chinese international students, a cohort study should be undertaken to examine trends in acculturation and self-construal and their relationship with physical activity, social cognitive predictors of physical activity, and mental health outcomes over time. Once a timeline of change is established,

relevant SCT variables could be targeted in Chinese international students to support their engagement in physical activity. Support from the university could be integrated in this intervention and will likely require combining a broad range of services (Jones, 2017).

In qualitative research with international students, reasons for increased physical activity during their studies were identified including seeing more people role modelling the behaviours, meeting domestic students, having more access to places to do the activities, motivation to manage their weight, and having more time (Z. Yan & FitzPatrick, 2016). These correlates could be added to future quantitative studies to identify the most relevant correlates and develop strategies to promote them on a wider scale. Finally, the role of friends and social support for physical activity over time should be examined with self-construal as a moderating variable. It is likely that more independent Chinese students will seek out more social support, but this needs to be confirmed in a behavioural context. Social network analysis could be used to better understand how social isolation occurs in this group, and how it is related to physical activity.

5.6. Strengths

The translation of the research instruments and testing of their structure with a large sample added rigor to the measurement of the constructs in the current project. In addition, Chinese international students in the Faculty of Kinesiology, Sport, and Recreation were a valuable resource in interpreting the results. The focus on only undergraduate Chinese international students strengthened the conclusions compared to studies that focus on international students in general, or graduate and undergraduate experiences together. According to life course theory age, social cohort, and life experience during transitions can impact psychosocial outcomes (Elder Jr & Shanahan, 2006). The heterogeneity within international students should be acknowledged by researchers when designing studies especially given the

evidence that culture can play a role in behaviour and mental health outcomes. The design of studies two and three allowed for insight into changes in the variables over time and this has not been addressed in this population. The patterns of adaptation, behaviour, and mental health are not well understood in international student or sojourner populations, and such designs permit the analyses of these trends. Focusing on behavioural antecedents and outcomes also added thoroughness to the investigation and the option to apply the findings in an intervention or applied health promotion setting.

5.7. Limitations

The current research program is limited by its generalizability. The nature of SCT is that it depends heavily on context. The findings are applicable to mainland Chinese international students in a large Northern Alberta institution. Other contexts may exhibit different patterns. The design of study three may not allow for representations of change over time because there could be differences between the samples that were not measured. The students were selected and analysed based on year of study, but the students could have arrived in Canada and been living in Canada prior to beginning their studies, allowing more time for acculturation. Indeed, Shim et al. (2014) found correlations between length of stay and independent self-construal when examining East Asians in Germany. More extensive limitations around the measures and recruitment are addressed in the following sections.

5.7.1. Measures

The measures were translated by volunteer bilingual graduate students. While they took their task very seriously, they were not professional translators and their interpretations of the questionnaires may have resulted in unintentional changes to the meaning of the items. In addition, it was not feasible to collect and compare the simplified Chinese version of the questionnaire with the English version with bilingual Chinese students in China. This is because

the survey would have been too long, likely resulting in drop-out or careless responding. There were also few potential participants who agreed to do this task. As a result, the test-retest results were done with only the Chinese version of the questionnaire.

Regarding specific questionnaires, intention, SWB, access, and LTPA items could have been improved. Intention may have not been an accurate measure of proximal goals or self-regulation. A scale with more items could have offered more insight into the construct of self-regulation. In addition, looking at relationships between intended future behaviour and behaviour in the past week may not be accurate if someone is planning to begin a new program. Rhodes and Rebar (2017) suggested that intention should be specified in terms of intention strength and intention decision. Our measurement may be slightly more indicative of intention strength, but participants may have responded based on an interpretation of the item as simply the decision to do the behaviour and not the strength of that decision. Specification of strength or decision should be clearer in future measurement of the construct.

The combination of life satisfaction and affect was a creative way to generate a measure of SWB for this sample, especially with the addition of low arousal positive emotional states. However, the measure may have been too broad conceptually to be related to physical activity which is potentially a small part of one's wellness conception. In addition, longitudinal research has shown that life satisfaction and SWB are likely very stable over time, and thus the anticipated changes may not have been realistic (Shek et al., 2017). The focus of the measure is on hedonic well-being, and perhaps incorporating aspects of eudaimonic well-being would have been more meaningful for the Chinese students given the potential Taoist and Buddhist influences on emotion (R. M. Ryan & Deci, 2001; Yik, 2010).

The sociostructural aspect measured in this study was perception of access, or places to do physical activity inside and outside the university. This measure cannot capture all the possible barriers and facilitators that exist for international students and a more thorough measure could have added to this dimension (e.g., cost, weather, equipment).

Measurement of time in Canada based on year of study may not have captured acculturation as intended. The assumption was made that first year students would have no prior experience in Canada, however, they may be in the first year of a new program after changing majors, or they may have moved to Canada prior to beginning their studies. Years spent in Canada may be a better indicator of a student's acculturative journey in conjunction with the acculturation measures.

Finally, although all the measures were self-reported and subject to recall bias, this may be a particularly salient issue for measurement of LTPA. Although the IPAQ has shown validity, some participants may not have accurately reported their physical activity. This may be especially problematic for activities like walking or unstructured activity which may be difficult to recall precisely. The large standard deviations reflect the variability in LTPA scores reported. Cases of extreme scores may have resulted in biased results despite attempts to remove or reduce the impact of outliers.

5.7.2. Validity

Another area of potential limitation in this project is in the instrument validity. Although some validity issues have been alluded to throughout the document, this issue warrants discussion. Overall, there were some areas of validity that were measured and established, and others that were not fully adequate. Several forms of construct and experimental validity have been identified that I will discuss in relation to the present study: face validity, content validity, convergent validity, criterion validity (including concurrent and predictive validity), factorial

validity, internal validity and external validity (Kelly, Fitzsimons, & Baker, 2016; Litwin, 1995). Many steps to address validity were taken during translation by the bilingual graduate students involved in study one. Some instruments were previously translated by another research group. The language proficiency measure and the accessibility measure were generated for this project.

The types of validity that were addressed in these studies are face and content validity, factorial validity, predictive and convergent validity, internal, and external validity. Face validity and content validity to a degree were addressed during translation. Throughout the translation process, theoretical rationale and knowledge of Chinese culture were constantly evaluated in relation to the survey items in order to ensure that the included items were representative of the constructs of interest and relevant for the population. This resulted in the removal or re-wording of some items to make them more appropriate for use with Chinese students. Factorial validity of the translated instruments was addressed in study one. Exploratory factor analyses allowed examination of factor structures in the translated instruments to be compared to the previously established structures of the English language instruments. Predictive (study two) and convergent validity (studies one and three) were examined by comparing bivariate correlational relationships between the variables of interest to theoretical relationships between the constructs. For example, SWB and stress were negatively related, while the SCT constructs were positively related to LTPA. Internal validation was done through missing variable analyses during data screening. Systematically missing data or patterns of missing data were not present in any of the samples collected for this project. Finally, external validity in this research is difficult to assess, but it can be assumed that the research is applicable to undergraduate Chinese international students studying in Canada at large institutions. The sample may be biased due to self-selection, but the

addition of data from the psychology pool may have broadened the sample to those who may not have selected into the study initially.

Criterion validation, particularly concurrent validation was not undertaken in this research mainly due to feasibility and participant burden. Many of the scales had already been assessed for reliability and validity in English, and the purpose of the research was not to develop new tools to measure the present constructs (Streiner, Norman, & Cairney, 2015). In addition, predictive and convergent validation were not completed with similar measures other than those already included in the analyses. Again, this is because the overall purpose of the project was not aimed at assessing this type of validity, and theoretical content validation was deemed adequate in evaluating the measures. Content validity could have been more formally examined using a panel of experts on the subject.

Overall, while there are shortcomings in the validation process undertaken with the translated measures, the care taken in translation, reliability measures, and the theoretically consistent relationships between the variables indicate that the measures are likely representative of the intended constructs.

5.7.3. Recruitment and sample size

Recruitment for studies two and three proved more difficult than anticipated in the proposal stages of this project. Data collection for the first year students ran from September 18 to November 23, 2017. Several efforts were undertaken to recruit as many Chinese international students at the University of Alberta and the University of Calgary as possible, beginning with communications involving University of Alberta International (UAI) and the Chinese Students and Scholars Association (CSSA) in June 2016. In the summer of 2017, the CSSA at the University of Calgary was contacted, and they agreed to help recruit students from their campus. In September 2017, the University of Alberta CSSA helped to create an article that advertised the

study to first year Chinese international students using their communication channels (Appendix F). Posters were hung on campus notice boards throughout the data collection period. The international student specialist at UAI disseminated information about the study via her social media. A call for participants was posted to the Chinese Students Club Facebook page. Finally, approximately 15 classes were visited, and a short presentation was given to ask for student participation in the study. The classes were in East Asian studies, Economics, Engineering, and seminar classes geared towards international students. Several other professors posted the recruitment information for students on eClass (online class management system). For the senior students, similar methods were used including posters, in class visits, and posts on social media. As a final effort, students were approached on campus in person and their participation was requested. Approximately 10 hours was dedicated to this final effort.

Some researchers have identified reasons that people choose to participate in survey research, which may apply to this population. The sympathy of the students to the survey outcomes or purpose could have determined their choice to respond (Ornstein, 2014). New international students may be unfamiliar with this type of research (e.g., aimed to improve future international student experiences indirectly; lack of exposure in China). In addition, students may not be exposed to psychology/ survey research in their classes or their research methods courses may not focus on research recruitment. The design of the survey itself may also have limitations contributing to poor data quality. Although self-administered questionnaires allow as much time as is needed for participants, careless responses and distractions may prevent quality responses to the items (Ornstein, 2014).

Two theories of survey participation that may also apply are reciprocation (Groves et al., 1992), and social exchange theory (Dillman, 1978). Both theories hinge on the social reward or

mutual trust between the respondent and the surveyor. A token or incentive can enhance the desire to obtain this social reward in the view of the participant. Posters or online messages may not have invoked this social obligation, and students may not have felt that making an impression on the surveyor would be socially valuable or worthwhile. Dillman and Groves both encourage a token of appreciation for respondents which is better to give before they participate. In my research, I offered a lottery for those who completed both parts of study two, and small tokens for those completing study one and three. Research on incentives demonstrated that lotteries reduce interest because participants do not expect to win, and the impact of a lottery incentive is usually negligible (Ernst Sthli & Joye, 2017).

A final theory that may be relevant is the leverage-saliency theory (Groves, Singer, & Corning, 2000). This theory predicts participation in a survey based on combinations of motivators and demotivators. Each person weighs the advantages and disadvantages of participation in conjunction with the survey design (e.g., incentive versus time demand). In our studies, participants were not given all the study details so as not to prime their responses which may inhibit willingness to participate. As well, promises about direct change or benefit to individual students could not be made because it is unethical to portray unrealistic outcomes based on one research study. Students may simply have been very busy at the beginning of the term in a new environment. They are given a lot of information and have many demands on their time and may not perceive research participation as a valuable undertaking. In China, many changes to policy or practice are made without public consultation, resulting in a lack of association between their experiences and beliefs, and subsequent outcomes. This differs from Western assumptions that changes can be made based on input from those affected by policy/ programs. Thus, Chinese students in Canada may not feel that voicing their opinions or

experiences is worthwhile. The reason that it was easier to recruit students in China may have been due to the social reward, or novelty of the researcher. In addition, the survey was not presented to the students in China as a way to change their university environment. For the students in Canada, however, they were told that they could impact the lives of future Chinese international students based on the results of the survey. All these factors in combination with many other possible personal and contextual factors likely determine how one will respond to a call for respondents at a certain moment in their lives.

It is likely that those who participated in the current research were part of a subset of students who are either altruistic and wish to help the researcher or adhere to cooperation norms, or who enjoy responding, learning about research, or value the incentive for their own gain (Singer & Ye, 2013). As such, the results likely reflect this subsection of Chinese international students at the University of Alberta and may be different from the larger population at the University and in Canada.

5.8. Recommendations and Conclusions

The current dissertation project showed that Chinese international students can benefit from participating in physical activity, and there may be some important correlates of this behaviour that should be promoted. In addition, the role of culture and acculturation were examined in relation to physical activity. Discussion of the results, however, often broadened to reference adaptation and strategies to reduce the stress of moving to another country to study. There are complex relationships between health behaviour, stress, academics, culture, sojourner status, and social relationships at play in the life of an international student. The following practical recommendations were developed from the existing literature and the findings from this research project.

First, it is apparent that improving acculturation and adaptation can lead to several positive mental health and physical health outcomes for international students. To do this, improved language training and cultural training should be a priority for international students. This can begin when the student is in their home country preparing to leave for study, and institutions can implement training opportunities for newcomers. In conjunction, opportunities for intercultural interaction and friendship formation could help both international and domestic students broaden their perspectives and improve their communication skills. These opportunities could be facilitated through active recreation or other initiatives.

Second, international students may prefer more informal, less time consuming recreational activities that still allow time to focus on academic priorities (Zhou et al., 2017). For example, a drop-in badminton, or guided nature walk could be offered. Third, students should learn how to set physical activity goals and regulate their behaviour through time-management strategies. This will target their intentions or proximal goal setting and help to habituate physical activity. Similarly, targeting self-efficacy may be beneficial in supporting mastery, coping, and scheduling for physical activity. Bandura (1997) offers four ways to improve self-efficacy; mastery experiences, verbal persuasion, vicarious experiences, and physiological and emotional states.

Fourth, cultural awareness may be a key component of program delivery. Chinese students may prefer to engage in activities that align with their affective preferences (lower arousal) to reduce their stress and improve SWB. More interdependent students may be less likely to seek out social support. Additionally, these preferences may change as students become more acculturated over time. Cognizance of these slight differences could encourage the creation of programming that aligns with the preferences of international students. Offering programming

with various intensity levels that do not require a partner or providing opportunities to make friends with interests in physical activity could help reduce the social burden on students. Such strategies may also reduce perceptions of discrimination by providing inclusive spaces.

Physical activity is one piece of an international student experience. The benefits of the behaviour, however, can have a large impact on adaptation, mental health, social health, and academic success. International students and institutions can work together to be successful in their academic and overall international experience. As universities continue to recruit international students they have a responsibility to provide meaningful experiences inside the classroom and in the broader university community.

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APPENDICES

Appendix A: Measures Included in Each Study

Scale/item	Study one (pilot)	Study two time I/ Study three (Survey A)	Study two time II (Survey B)
Age	X	X	
Gender	X	X	
Height/weight	X	X	X
Department/Faculty	X	X	
Year of study	X	X	
Birthplace	X	X	
Sports/activities	X	X	
International school		X	
English language proficiency	X	X	
Exercise Motivation Inventory 2- Stress Management	X	X	X
Stay at U of A			X
Stay in Canada		X	X
Accessibility perception	X	X	X
Participant #			X
Multidimensional Exercise Self-efficacy Scale	X	X	X
Intention	X	X	X
Friend Support for Exercise Habits Scale	X	X	X
Self-Construal Scale	X	X	X
Vancouver Index of Acculturation		X	X
Perceived Stress Scale	X	X	X
Acculturative Stress Scale for College Students in the US		X	X
Satisfaction with Life Scale (SWB)	X	X	X
Affect Valuation Index Actual affect only	X	X	X
International Physical Activity Questionnaire	X	X	X

Appendix B: Survey A (Long)

Please enter your university e-mail so we may contact you for the second part of the survey:

_____

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE- Short last seven days

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ **days per week**

   ☐ No vigorous physical activities → ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one of those days?

   _____ **hours per day**

   _____ **minutes per day**

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or badminton? Do not include walking.

_____ **days per week**

☐ No moderate physical activities → ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Multidimensional Exercise Self-efficacy Scale

Moderate intensity physical activity (MPA) includes activities such as fast walking, basketball, tennis, easy bicycling, and swimming. It is recommended that adults complete 150 minutes of MPA per week. Please indicate your confidence that you can complete the recommended amount of physical activity in the following situations from 0% (not at all confident) – 100% (completely confident).

	Confidence level (0-100%)
How confident are you that you can follow directions to complete MPA?	
How confident are you that you can perform all activities required for complete MPA?	
How confident are you that you can perform MPA when you do not feel well?	
How confident are you that you can arrange your schedule to include MPA?	
How confident are you that you can consistently perform MPA?	
How confident are you that you can complete MPA using proper technique?	
How confident are you that you can perform MPA when you lack energy?	
How confident are you that you can perform MPA when you feel discomfort when performing physical activity?	
How confident are you that you can include MPA in your daily routine?	

Intention

Please circle the most accurate response to the following question:

I intend to do moderate physical activity for 150 minutes in the next week.

unlikely	1	2	3	4	5	6	7	likely

Friend Support for Exercise Habits Scale

Please indicate how many times in the past week a friend has done the following things from 1 (*never*) to 5 (*7 or more times*).

	1 (never)	2	3	4	5 (7 or more times)
Exercised with me	1	2	3	4	5
Offered to exercise with me	1	2	3	4	5
Gave me helpful reminders to exercise	1	2	3	4	5
Gave me encouragement to stick with my exercise program	1	2	3	4	5
Changed their schedule so we could exercise together	1	2	3	4	5

Vancouver Index of Acculturation

Please answer each question as carefully as possible. Circle *one* of the numbers to the right of each question to indicate your degree of agreement or disagreement.

	Strongly Disagree		**Disagree**		**Neutral/ Depends**		**Agree**		**Strongly Agree**
1. I often participate in my *Chinese cultural* traditions	1	2	3	4	5	6	7	8	9
2. I often participate in mainstream Canadian cultural traditions	1	2	3	4	5	6	7	8	9
3. I would be willing to marry a person from my *Chinese culture*.	1	2	3	4	5	6	7	8	9
4. I would be willing to marry a Canadian person.	1	2	3	4	5	6	7	8	9
5. I enjoy social activities with people from the same *Chinese culture* as myself.	1	2	3	4	5	6	7	8	9
6. I enjoy social activities with typical Canadian people. ..	1	2	3	4	5	6	7	8	9
7. I am comfortable working with people of the same *Chinese culture* as myself.	1	2	3	4	5	6	7	8	9
8. I am comfortable working with typical Canadian people	1	2	3	4	5	6	7	8	9
9. I enjoy entertainment (e.g. movies, music) from my *Chinese culture*.	1	2	3	4	5	6	7	8	9
10. I enjoy Canadian entertainment (e.g. movies, music).	1	2	3	4	5	6	7	8	9
11. I often behave in ways that are typical of my *Chinese culture*.	1	2	3	4	5	6	7	8	9
12. I often behave in ways that are 'typically Canadian.'	1	2	3	4	5	6	7	8	9
13. It is important for me to maintain or develop the practices of my *Chinese culture*.	1	2	3	4	5	6	7	8	9

14. It is important for me to maintain or develop Canadian cultural practices.	1	2	3	4	5	6	7	8	9
15. I believe in the values of my *Chinese culture*.	1	2	3	4	5	6	7	8	9
16. I believe in mainstream Canadian values.	1	2	3	4	5	6	7	8	9
17. I enjoy the jokes and humor of my *Chinese culture*.	1	2	3	4	5	6	7	8	9
18. I enjoy typical Canadian jokes and humor.	1	2	3	4	5	6	7	8	9
19. I am interested in having friends from my *Chinese culture.*	1	2	3	4	5	6	7	8	9
20. I am interested in having Canadian friends.	1	2	3	4	5	6	7	8	9

Self- construal scale

Please indicate your agreement with the following statements.

1. I always try to have my own opinions

Strongly disagree 1	2	3	4	Strongly agree 5

2. The best decisions for me are the ones I made by myself

Strongly disagree 1	2	3	4	Strongly agree 5

3. In general I make my own decisions

Strongly disagree 1	2	3	4	Strongly agree 5

4. I act the same way no matter who I am with

Strongly disagree 1	2	3	4	Strongly agree 5

5. I am not concerned if my ideas or behaviour are different from those of other people

Strongly disagree 1	2	3	4	Strongly agree 5

6. I always express my opinions clearly [in a straightforward manner (in the language I am most comfortable with)]

Strongly disagree 1	2	3	4	Strongly agree 5

7. Being able to take care of myself is a primary concern for me

Strongly disagree 1	2	3	4	Strongly agree 5

8. I enjoy being unique and different from others in many respects

Strongly disagree 1	2	3	4	Strongly agree 5

9. I do my own thing, regardless of what others think

Strongly disagree 1	2	3	4	Strongly agree 5

10. I am concerned about what people think of me

Strongly disagree 1	2	3	4	Strongly agree 5

11. In my own personal relationships I am concerned about the other person's status compared to me and the nature of our relationship

Strongly disagree 1	2	3	4	Strongly agree 5

12. I think it is important to keep good relations among one's acquaintances

Strongly disagree 1	2	3	4	Strongly agree 5

13. I avoid having conflicts with members of my group

Strongly disagree 1	2	3	4	Strongly agree 5

14. I respect people who are modest about themselves

Strongly disagree 1	2	3	4	Strongly agree 5

15. I feel my fate is intertwined with the fate of those around me

Strongly disagree 1	2	3	4	Strongly agree 5

16. Depending on the situation and the people that are present, I will sometimes change my attitude to behaviour

Strongly disagree 1	2	3	4	Strongly agree 5

Acculturative Stress Scale for Chinese College Students in the United States

This scale describes some stressful situations that might occur to you after you come to Canada Please circle the number that BEST describes your experience, using following scale: 1=never---2---3=sometimes---4---5=often---6---7=all the time.							
1. I hesitate to participate in class discussion and seminar.	1	2	3	4	5	6	7
2. My social circles shrank after I came to Canada	1	2	3	4	5	6	7
3. I feel that I receive unequal treatment.	1	2	3	4	5	6	7
4. I feel helpless.	1	2	3	4	5	6	7
5. I feel a lot of academic pressure.	1	2	3	4	5	6	7
6. I am treated differently because of my race.	1	2	3	4	5	6	7
7. It is hard for me to follow the lectures and conversations in classes.	1	2	3	4	5	6	7
8. I cannot express myself very well when using English.	1	2	3	4	5	6	7
9. I do not have many friends in Canada	1	2	3	4	5	6	7
10. I don’t feel a sense of belonging (community) here.	1	2	3	4	5	6	7
11. People from some other ethnic groups show hatred toward me.	1	2	3	4	5	6	7
12. I worry about my parents.	1	2	3	4	5	6	7
13. I feel nervous to communicate in English.	1	2	3	4	5	6	7
14. I feel that others are biased toward me.	1	2	3	4	5	6	7
15. I often have to work overtime in order to catch up.	1	2	3	4	5	6	7
16. I feel bored here.	1	2	3	4	5	6	7
17. I feel that my people are discriminated against.	1	2	3	4	5	6	7
18. I feel frustrated that I am not able to participate in class discussions.	1	2	3	4	5	6	7
19. I feel guilty to leave my family and friends behind.	1	2	3	4	5	6	7
20. I am not used to the English way of thinking.	1	2	3	4	5	6	7

21. I have limited social life.	1	2	3	4	5	6	7
22. I feel angry that my people are considered inferior here.	1	2	3	4	5	6	7
23. I lack confidence when I have to do presentations in English.	1	2	3	4	5	6	7
24. The intensive study makes me sick.	1	2	3	4	5	6	7
25. I feel guilty that I cannot take care of my parents.	1	2	3	4	5	6	7
26. My vocabulary is so small that I always feel short of words.	1	2	3	4	5	6	7
27. I feel lonely in Canada	1	2	3	4	5	6	7
28. I feel some people don't associate with me because of my ethnicity.	1	2	3	4	5	6	7
29. It is a big pressure for me to publish academic paper in English.	1	2	3	4	5	6	7
30. I shy away from social situations due to my limited English.	1	2	3	4	5	6	7
31. I do not have new social network here.	1	2	3	4	5	6	7
32. Academic pressure has lowered the quality of my life.	1	2	3	4	5	6	7

Perceived Stress Scale- 10 Item

The questions in this scale ask you about your feelings and thoughts during the last week. In each case, please indicate with a check how often you felt or thought a certain way.

1. In the last week, how often have you been upset because of something that happened unexpectedly?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

2. In the last week, how often have you felt that you were unable to control the important things in your life?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

3. In the last week, how often have you felt nervous and "stressed"?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

4. In the last week, how often have you felt confident about your ability to handle your personal problems?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

5. In the last week, how often have you felt that things were going your way?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

6. In the last week, how often have you found that you could not cope with all the things that you had to do?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

7. In the last week, how often have you been able to control irritations in your life?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

8. In the last week, how often have you felt that you were on top of things?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

9. In the last week, how often have you been angered because of things that were outside of your control?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

10. In the last week, how often have you felt difficulties were piling up so high that you could not overcome them?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

Satisfaction with Life Scale

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

1 - Strongly disagree	2 - Disagree	3 - Slightly disagree	4 - Neither agree nor disagree	5 - Slightly agree	6 - Agree	7 - Strongly agree

____ In most ways my life is close to my ideal.

____ The conditions of my life are excellent.

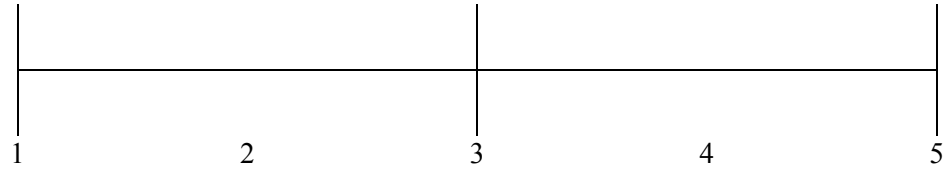
____ I am satisfied with my life.

____ So far I have gotten the important things I want in life.

Affect Valuation Index

Listed below are a number of words that describe feelings. Some of the feelings are very similar to each other, whereas others are very different from each other.

Now, please read each word and rate how often YOU ACTUALLY HAVE that feeling over the course of <u>a typical week</u>, using the following scale:



1	2	3	4	5
Never	A small amount of the time	Half the time	Most of the time	All the time

Over the course of a typical week, I ACTUALLY feel…

enthusiastic _____ nervous _____

dull _____ relaxed _____

excited _____ elated _____

sleepy _____ lonely _____

sluggish _____ content _____

euphoric _____ sad _____

fearful _____ happy _____

calm _____ unhappy _____

hostile _____ satisfied _____

peaceful _____ serene _____

Demographic/Other Questions

1. How old are you in years?
2. What is your gender?
3. How tall are you? _____cm
4. What is your weight? _____kg
5. What program will you study at the University of Alberta?
6. What year did you arrive in Canada? *added for surveys started in September 2018
7. Where were you born in mainland China?
8. What sport or exercise activities did you participate in in China?
9. Did you attend an international school in China?
10. After your time at the University of Alberta, where do you plan to work/live?

    (CAN/CHN/OTHER)

11. What sports or fitness activities do you participate in in Canada?
12. Does the University of Alberta offer you opportunities to participate in physical activity in your spare time?

1- Never	2	3	4- Sometimes	5	6	7-All the time

13. Are there opportunities to participate in physical activity in your spare time *outside* of the University of Alberta?

1-Never	2	3	4- Sometimes	5	6	7-All the time

Exercise Motivation

Here are three statements concerning the reasons people often give when asked why they exercise. *Whether you currently exercise regularly or not,* please read each statement carefully and indicate, by circling the appropriate number, whether or not each statement *is true* for you personally, *or would be true* for you personally if you did exercise. If you do not consider a statement to be true for you at all, circle the '0'. If you think that a statement is very true for you indeed, circle the '5'. If you think that a statement is partly

true for you, then circle the '1', '2', '3' or '4', according to how strongly you feel that it reflects why you exercise or might exercise.

Remember, we want to know why *you personally* choose to exercise or might choose to exercise, not whether you think the statements are good reasons for *anybody* to exercise.

	Not at all true for me					Very true for me
To give me space to think	0	1	2	3	4	5
Because it helps to reduce tension	0	1	2	3	4	5
To help manage stress	0	1	2	3	4	5

14. Please rate your English language proficiency for the following skills:

Reading English:

1- Very low	2	3	4- moderate	5	6	7- Extremely high

Writing in English:

2- Very low	2	3	4- moderate	5	6	7- Extremely high

Speaking in English:

3- Very low	2	3	4- moderate	5	6	7- Extremely high

Listening to English:

4- Very low	2	3	4- moderate	5	6	7- Extremely high

Appendix C: Survey B (Short)

Please enter your participant ID provided by the researcher:

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE- Short last seven days

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

5. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

☐ No vigorous physical activities → ***Skip to question 3***

6. How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

7. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or badminton? Do not include walking.

_____ **days per week**

☐ No moderate physical activities → ***Skip to question 5***

8. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐ No walking → ***Skip to question 7***

8. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

9. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Multidimensional Exercise Self-efficacy Scale

Moderate intensity physical activity (MPA) includes activities such as fast walking, basketball, tennis, easy bicycling, and swimming. It is recommended that adults complete 150 minutes of MPA per week. Please indicate your confidence that you can complete the recommended amount of physical activity in the following situations from 0% (not at all confident) – 100% (completely confident).

	Confidence level (0-100%)
How confident are you that you can follow directions to complete MPA?	
How confident are you that you can perform all activities required for complete MPA?	
How confident are you that you can perform MPA when you do not feel well?	
How confident are you that you can arrange your schedule to include MPA?	
How confident are you that you can consistently perform MPA?	
How confident are you that you can complete MPA using proper technique?	
How confident are you that you can perform MPA when you lack energy?	
How confident are you that you can perform MPA when you feel discomfort when performing physical activity?	
How confident are you that you can include MPA in your daily routine?	

Intention

Please circle the most accurate response to the following question:

I intend to do moderate physical activity for 150 minutes in the next week.

unlikely	1	2	3	4	5	6	7	likely

Friend Support for Exercise Habits Scale

Please indicate how many times in the past week a friend has done the following things from 1 (*never*) to 5 (*7 or more times*).

	1 (never)	2	3	4	5 (7 or more times)
Exercised with me	1	2	3	4	5
Offered to exercise with me	1	2	3	4	5
Gave me helpful reminders to exercise	1	2	3	4	5
Gave me encouragement to stick with my exercise program	1	2	3	4	5
Changed their schedule so we could exercise together	1	2	3	4	5

Vancouver Index of Acculturation

Please answer each question as carefully as possible. Circle *one* of the numbers to the right of each question to indicate your degree of agreement or disagreement.

	Strongly Disagree		**Disagree**		**Neutral/ Depends**		**Agree**		**Strongly Agree**
1. I often participate in my *Chinese cultural* traditions	1	2	3	4	5	6	7	8	9
2. I often participate in mainstream Canadian cultural traditions	1	2	3	4	5	6	7	8	9
3. I would be willing to marry a person from my *Chinese culture*.	1	2	3	4	5	6	7	8	9
4. I would be willing to marry a Canadian person.	1	2	3	4	5	6	7	8	9
5. I enjoy social activities with people from the same *Chinese culture* as myself.	1	2	3	4	5	6	7	8	9
6. I enjoy social activities with typical Canadian people. ..	1	2	3	4	5	6	7	8	9
7. I am comfortable working with people of the same *Chinese culture* as myself.	1	2	3	4	5	6	7	8	9
8. I am comfortable working with typical Canadian people	1	2	3	4	5	6	7	8	9
9. I enjoy entertainment (e.g. movies, music) from my *Chinese culture*.	1	2	3	4	5	6	7	8	9
10. I enjoy Canadian entertainment (e.g. movies, music).	1	2	3	4	5	6	7	8	9
11. I often behave in ways that are typical of my *Chinese culture*.	1	2	3	4	5	6	7	8	9
12. I often behave in ways that are 'typically Canadian.'	1	2	3	4	5	6	7	8	9
13. It is important for me to maintain or develop	1	2	3	4	5	6	7	8	9

the practices of my *Chinese culture*.									
14. It is important for me to maintain or develop Canadian cultural practices.	1	2	3	4	5	6	7	8	9
15. I believe in the values of my *Chinese culture*.	1	2	3	4	5	6	7	8	9
16. I believe in mainstream Canadian values.	1	2	3	4	5	6	7	8	9
17. I enjoy the jokes and humor of my *Chinese culture*.	1	2	3	4	5	6	7	8	9
18. I enjoy typical Canadian jokes and humor.	1	2	3	4	5	6	7	8	9
19. I am interested in having friends from my *Chinese culture.*	1	2	3	4	5	6	7	8	9
20. I am interested in having Canadian friends.	1	2	3	4	5	6	7	8	9

Self- construal scale

Please indicate your agreement with the following statements.

1. I always try to have my own opinions

Strongly disagree 1	2	3	4	Strongly agree 5

2. The best decisions for me are the ones I made by myself

Strongly disagree 1	2	3	4	Strongly agree 5

3. In general I make my own decisions

Strongly disagree 1	2	3	4	Strongly agree 5

4. I act the same way no matter who I am with

Strongly disagree 1	2	3	4	Strongly agree 5

5. I am not concerned if my ideas or behaviour are different from those of other people

Strongly disagree 1	2	3	4	Strongly agree 5

6. I always express my opinions clearly [in a straightforward manner (in the language I am most comfortable with)]

Strongly disagree 1	2	3	4	Strongly agree 5

7. Being able to take care of myself is a primary concern for me

Strongly disagree 1	2	3	4	Strongly agree 5

8. I enjoy being unique and different from others in many respects

Strongly disagree 1	2	3	4	Strongly agree 5

9. I do my own thing, regardless of what others think

Strongly disagree 1	2	3	4	Strongly agree 5

10. I am concerned about what people think of me

Strongly disagree 1	2	3	4	Strongly agree 5

11. In my own personal relationships I am concerned about the other person's status compared to me and the nature of our relationship

Strongly disagree 1	2	3	4	Strongly agree 5

12. I think it is important to keep good relations among one's acquaintances

Strongly disagree 1	2	3	4	Strongly agree 5

13. I avoid having conflicts with members of my group

Strongly disagree 1	2	3	4	Strongly agree 5

14. I respect people who are modest about themselves

Strongly disagree 1	2	3	4	Strongly agree 5

15. I feel my fate is intertwined with the fate of those around me

Strongly disagree 1	2	3	4	Strongly agree 5

16. Depending on the situation and the people that are present, I will sometimes change my attitude to behaviour

Strongly disagree 1	2	3	4	Strongly agree 5

Acculturative Stress Scale for Chinese College Students in the United States

This scale describes some stressful situations that might occur to you after you come to Canada Please circle the number that BEST describes your experience, using following scale: 1=never---2---3=sometimes---4---5=often---6---7=all the time.							
1. I hesitate to participate in class discussion and seminar.	1	2	3	4	5	6	7
2. My social circles shrank after I came to Canada	1	2	3	4	5	6	7
3. I feel that I receive unequal treatment.	1	2	3	4	5	6	7
4. I feel helpless.	1	2	3	4	5	6	7
5. I feel a lot of academic pressure.	1	2	3	4	5	6	7
6. I am treated differently because of my race.	1	2	3	4	5	6	7
7. It is hard for me to follow the lectures and conversations in classes.	1	2	3	4	5	6	7
8. I cannot express myself very well when using English.	1	2	3	4	5	6	7
9. I do not have many friends in Canada	1	2	3	4	5	6	7
10. I don't feel a sense of belonging (community) here.	1	2	3	4	5	6	7
11. People from some other ethnic groups show hatred toward me.	1	2	3	4	5	6	7
12. I worry about my parents.	1	2	3	4	5	6	7
13. I feel nervous to communicate in English.	1	2	3	4	5	6	7
14. I feel that others are biased toward me.	1	2	3	4	5	6	7
15. I often have to work overtime in order to catch up.	1	2	3	4	5	6	7
16. I feel bored here.	1	2	3	4	5	6	7
17. I feel that my people are discriminated against.	1	2	3	4	5	6	7
18. I feel frustrated that I am not able to participate in class discussions.	1	2	3	4	5	6	7
19. I feel guilty to leave my family and friends behind.	1	2	3	4	5	6	7
20. I am not used to the English way of thinking.	1	2	3	4	5	6	7

21. I have limited social life.	1	2	3	4	5	6	7
22. I feel angry that my people are considered inferior here.	1	2	3	4	5	6	7
23. I lack confidence when I have to do presentations in English.	1	2	3	4	5	6	7
24. The intensive study makes me sick.	1	2	3	4	5	6	7
25. I feel guilty that I cannot take care of my parents.	1	2	3	4	5	6	7
26. My vocabulary is so small that I always feel short of words.	1	2	3	4	5	6	7
27. I feel lonely in Canada	1	2	3	4	5	6	7
28. I feel some people don't associate with me because of my ethnicity.	1	2	3	4	5	6	7
29. It is a big pressure for me to publish academic paper in English.	1	2	3	4	5	6	7
30. I shy away from social situations due to my limited English.	1	2	3	4	5	6	7
31. I do not have new social network here.	1	2	3	4	5	6	7
32. Academic pressure has lowered the quality of my life.	1	2	3	4	5	6	7

Perceived Stress Scale- 10 Item

The questions in this scale ask you about your feelings and thoughts during the last week. In each case, please indicate with a check how often you felt or thought a certain way.

1. In the last week, how often have you been upset because of something that happened unexpectedly?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

2. In the last week, how often have you felt that you were unable to control the important things in your life?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

3. In the last week, how often have you felt nervous and "stressed"?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

4. In the last week, how often have you felt confident about your ability to handle your personal problems?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

5. In the last week, how often have you felt that things were going your way?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

6. In the last week, how often have you found that you could not cope with all the things that you had to do?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

7. In the last week, how often have you been able to control irritations in your life?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

8. In the last week, how often have you felt that you were on top of things?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

9. In the last week, how often have you been angered because of things that were outside of your control?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

10. In the last week, how often have you felt difficulties were piling up so high that you could not overcome them?

0=never	1=almost never	2=sometimes	3=fairly often	4=very often

Satisfaction with Life Scale

Below are five statements that you may agree or disagree with. Using the 1 - 7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

1 - Strongly disagree	2 - Disagree	3 - Slightly disagree	4 - Neither agree nor disagree	5 - Slightly agree	6 - Agree	7 - Strongly agree

____ In most ways my life is close to my ideal.

____ The conditions of my life are excellent.

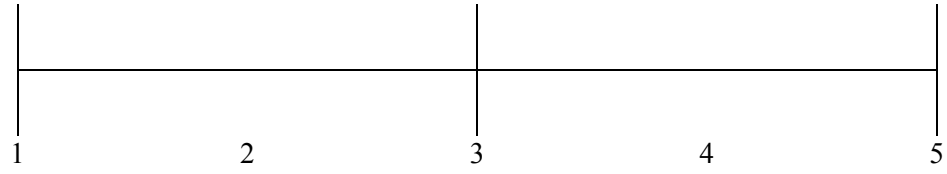
____ I am satisfied with my life.

____ So far I have gotten the important things I want in life.

Affect Valuation Index

Listed below are a number of words that describe feelings. Some of the feelings are very similar to each other, whereas others are very different from each other.

Now, please read each word and rate how often YOU ACTUALLY HAVE that feeling over the course of <u>a typical week</u>, using the following scale:



1	2	3	4	5
Never	A small amount of the time	Half the time	Most of the time	All the time

Over the course of a typical week, I ACTUALLY feel…

enthusiastic _____	nervous _____
dull _____	relaxed _____
excited _____	elated _____
sleepy _____	lonely _____
sluggish _____	content _____
euphoric _____	sad _____
fearful _____	happy _____
calm _____	unhappy _____
hostile _____	satisfied _____
peaceful _____	serene _____

Demographic/Other Questions

15. How tall are you? _____cm

16. What is your weight? _____kg

17. Do you intend to stay at the University of Alberta for the rest of your degree? (YES/NO)

18. After your time at the University of Alberta, where do you plan to work/live?

    (CAN/CHN/OTHER)

19. Does the University of Alberta offer you opportunities to participate in physical activity in your spare time?

2- Never	2	3	4- Sometimes	5	6	7-All the time

20. Are there opportunities to participate in physical activity in your spare time *outside* of the University of Alberta?

3- Never	2	3	4- Sometimes	5	6	7-All the time

Exercise Motivation

Here are three statements concerning the reasons people often give when asked why they exercise. *Whether you currently exercise regularly or not,* please read each statement carefully and indicate, by circling the appropriate number, whether or not each statement *is true* for you personally, *or would be true* for you personally if you did exercise. If you do not consider a statement to be true for you at all, circle the '0'. If you think that a statement is very true for you indeed, circle the '5'. If you think that a statement is partly true for you, then circle the '1', '2', '3' or '4', according to how strongly you feel that it reflects why you exercise or might exercise.

Remember, we want to know why *you personally* choose to exercise or might choose to exercise, not whether you think the statements are good reasons for *anybody* to exercise.

	Not at all true for me					Very true for me
To give me space to think	0	1	2	3	4	5
Because it helps to reduce tension	0	1	2	3	4	5
To help manage	0	1	2	3	4	5

stress						

21. Please rate your English language proficiency for the following skills:

Reading English:

5- Very low	2	3	4- moderate	5	6	7- Extremely high

Writing in English:

6- Very low	2	3	4- moderate	5	6	7- Extremely high

Speaking in English:

7- Very low	2	3	4- moderate	5	6	7- Extremely high

Listening to English:

8- Very low	2	3	4- moderate	5	6	7- Extremely high

If you like to be entered into a draw to win a $100.00 gift card to Best Buy:
Please answer this skill testing question: (38+12)/10 = _____
Please enter your e-mail:_____

Appendix D: Affect Valuation Index

Table D1.

Affect Valuation Index items and translation

Item number	Chinese translation	English
1	热诚	enthusiastic
2	惊愕	astonished
3	紧张	nervous
4	乏味	dull
5	安静	quiet
6	放松	relaxed
7	兴奋	excited
8	惊讶	surprised
9	兴高采烈	elated
10	困倦	sleepy
11	静止	still
12	孤独	lonely
13	强大	strong
14	被动	passive
15	满足	content
16	迟缓	sluggish
17	不动	inactive
18	伤心	sad
19	欣喜若狂	euphoric
20	恐惧	fearful
21	快乐	happy
22	无所事事	idle
23	冷静	calm
24	不快乐	unhappy
25	激发	aroused
26	有敌意	hostile
27	满意	satisfied
28	休息好	rested
29	平和	peaceful

30	平静	serene
31	没有情绪/感觉	no emotion
32	充满活力	energetic
33	羞愧	ashamed
34	恶心	disgusted
35	有压力	stressed
36	内疚	guilty
37	蔑视	contemptuous
38	疲劳	fatigued
39	生气	angry

Table D2.

Affect Valuation Index coding

Octant		Items included				
Positive	High arousal	1	7	19	9	
	Positive	15	21	27		
	Low arousal	6	23	29	30	
Low arousal		5	11	14		
Negative	Low arousal	4	10	16		
	Negative	12	18	24		
	High arousal	3	20	26		
High arousal		2	8	25		
Not included		13	17	22	28	31-39

Appendix E: Additional Analyses Study One, Part III

Sex differences

Sex differences were tested by constraining the model by gender, and comparing model fit to the model that was not constrained. When the constrained model was compared with the unconstrained model, the model fit did not improve using the MLR estimator χ^2_{diff} = TRd 5.73, *df* = 4, *p* > .05.

Exercise as a coping mechanism

Exercise as a coping mechanism for stress was examined as a moderating variable using the method described in Maslowsky, Jager, and Hemken (2015). This method uses a log-likelihood ratio test to compare model 0 (no moderator) and model 1 (moderator included; Maslowsky et al., 2015). To do this, exercise as a coping mechanism (EMI) was added as a 'predictor' in the model. Model 0 showed acceptable fit, χ^2 (81) = 105.25, *p* = .03; RMSEA = .03, 90% CI [.01 - .04], SRMR = .04, CFI = .98, H0 = -5452.16.

Next, EMI was added as a moderator on MPA (H0 = -5389.84, D = 237.87, df = 1, p < .05). Because the change is significant at p < .05, we can conclude that model 1 is also a well-fitting model. The moderator variable (EMI x MPA) was not significantly related to stress (β = -.067, p = .17) or SWB (β = .069, p = .17). Similarly, when EMI was tested as a moderator on VPA (H0 = -5508.78, D = 327, df = 1, *p* < .05) it was also a well-fitting model, but the moderated relationship was not significant for stress (β = -.077, p = .61), or SWB (β = .041, p = .32). In both models the convergence criteria was decreased to .0001.

Appendix F: Recruitment Materials

Study Two

CSSA Article

开学两周了，作为大一的萌新，是否会因学业压力而感到压力山大？是否会因漂泊他乡而感到力不从心？

Don't Worry！

现在，我们将邀请所有的萌新在问卷中说出你们的迷茫，说出你们的困惑，说出所有对学校设施，生活选课上的不满。你们所提到的问题，都有可能因调查结果而改善。

来自 Faculty of Physical Education and Recreation 四年级的博士候选人，Kim Curtin 学长在招募志愿者（大一新生，大三大四学长）参与网上问卷调查，从而帮助中国留学生更好地适应异国他乡的生活。

对于**年龄在 17 岁以上、能够使用互联网、对这项研究有兴趣的阿尔伯塔或卡尔加里大学的大一新生，大三大四学长**，你们将被邀请填写两次网络问卷，第一份于近期填写，第二份于 2018 年三月填写。问卷中提供的所有答案都将是珍贵的研究数据和信息，同时，这份问卷也会帮助大一新生们找到学习和生活上的盲点。当然，为了帮助萌新们解决一部分的经济压力，在完成两次问卷之后，所有萌新将会进入到 **BestBuy100 加元优惠券**的抽奖活动中。100 加元优惠券等着你哦！

而即将毕业的大三大四的学长们在问卷中提供的宝贵的留学经验一定能够给萌新带来极大的帮助，从而更好地解决中国留学生在学业和生活上所遇到的问题。

虽然不管是大一萌新还是大三大四的学长，现在都在经历大学生涯中十分忙碌和重要的阶段，但我们仍然恳切希望更多的人参与到这项研究调查中。同是中国人，同样如无根浮萍般客异他乡，但只要大家相聚相助，彼此间也能感受到温暖。

感兴趣的同学可以前往如下链接，开始填答问卷：www.wjx.cn/jq/16523417.aspx

如果大家心有迷茫，或者愿意分享宝贵的经验并愿意参与本次研究，请发邮件到 kcurtin@ualberta.ca

提前感谢你们的参与和帮助！

文字编辑：张萌

Translation:

Two weeks after school, as a freshman, will it feel pressured by academic pressure? Will you feel powerless because of drifting around?

Don’t Worry!

Now, we will invite all of first years to tell your confusion in the questionnaire, tell your confusion, and say all the dissatisfaction with the school facilities and life choices. The problems you mentioned may all be improved by the results of the survey.

A Ph.D. candidate from the fourth grade of Faculty of Physical Education and Recreation, Kim Curtin's seniors recruited volunteers (first-year freshmen, juniors and seniors) to participate in online surveys to help Chinese students better adapt to life in a foreign country.

For freshmen who are over 17 years old, able to use the Internet, interested in this research, or a freshman at Calgary University, you will be invited to fill out two online questionnaires, the first one Fill in recently and the second one will be completed in March 2018. All the answers provided in the questionnaire will be valuable research data and information. At the same time, this questionnaire will help freshmen to find blind spots in study and life. Of course, in order to help participants to solve part of the economic pressure, after completing the two questionnaires, all participants will enter the lucky draw of the BestBuy100 Canadian dollar coupon. A $100 coupon is waiting for you!

The valuable study abroad experience provided by the graduating juniors and seniors in the questionnaire will definitely bring great help to students, so as to better solve the problems encountered by Chinese students in their studies and life.

Although both the freshmen and the juniors and seniors are now in a very busy and important stage in college, we are still eager to see more people participate in this research. The same Chinese, the same as the rootless duckweed like a stranger, but as long as everyone gathers and help each other, they can feel warmth.

Interested students can go to the following link to start the questionnaire:
www.wjx.cn/jq/16523417.aspx

If you are confused or willing to share valuable experience and are willing to participate in this study, please send an email to kcurtin@ualberta.ca

Thank you in advance for your participation and help!

Text editor: Zhang Meng

[redacted]

一年级的中国留学生们！

特邀您参与博士论文的调查研究！

完成了两次问卷之后，您将进入到 BestBuy100 **加元**优惠券的抽奖活动。您在问卷中提供的答案将是非常有价值的研究数据和信息，这将有助于我校改进与中国留学生相关的服务和项目。

请从以下链接进入研究（研究主题：大学生健康行为）

https://www.wjx.cn/jq/16136219.aspx

Thank you! 谢谢

Facebook recruitment post

Are you a First year Chinese international student?

您是来自中国的大一新生吗？

If yes, you are invited to participate in a research study examining health behaviours of Chinese international students. You will be asked to complete a questionnaire online which will take approximately 15 minutes. You will do the questionnaire now, and once more in March, 2018. If you complete both parts of the study, you can enter a draw to win a $100.00 gift card to Best Buy!

如果您目前是阿尔伯塔大学的中国留学生新生，我们特邀您参与到一项关于中国留学生健康行为的研究。我们需要您填写两份大约在时长在 30 分钟左右的问卷，第一份目前填写，第二份于 2018 年三月填写。如果您完成了两次问卷，您将进入抽奖以获取 BestBuy 的 100 加元优惠券。

Please contact Kim at kcurtin@ualberta.ca for more information! Or you can begin the survey by going to this link: www.wjx.cn/jq/16136219.aspx

如果您希望了解关于此项研究的更多信息，请通过 Email 联系 Kim。您也可以直接点击以下链接以开始回答问卷：

Study Three
CSSA Article
你好！（Hello!）
我叫 Kim Curtin，目前是体育与游憩学院的四年级博士候选人。（My name is Kim Curtin, and I am a fourth year PhD candidate in the Faculty of Physical Education and Recreation.）我想研究中国留学生在阿尔伯塔大学和卡尔加里大学的适应过程。（ I am interested in how Chinese international students are adjusting to life at the University of Alberta and University of Calgary.）

我正在招募志愿者参与我的网上问卷调查。（I am looking for participants to complete my online survey.）你的参与将帮助到未来的中国留学生，因为你所提供的宝贵研究数据将用于学校服务设施的改善和关于特定人群的知识积累。（ By doing the survey, you will also be helping out future Chinese international students by providing valuable research data that can be used to improve services on campus and knowledge about this specific population.）

我理解现在是你大学生涯中十分忙碌和重要的阶段，但我仍然恳切希望你能参与我的研究。这对于我的博士课题，以及你所在的中国留学生群体，都十分重要。（I know this is a busy and important time in your academic careers. Please consider helping out a fellow academic and assisting your student community by participating in this research.）
如果你：（If you are:）
-年龄在 18 岁以上（Over 18 years of age）
-是阿尔伯塔大学三年级或四年级的学生（In your third or fourth of study at the University of Alberta）
-能够上网（have access to the internet）
-愿意参与本研究（willing to participate in this research）
请发邮件到我的邮箱 kcurtin@ualberta.ca（Please contact me at kcurtin@ualberta.ca）
或者，你也可以前往如下链接，开始填答问卷：www.wjx.cn/jq/16523417.aspx
（Or, you may begin the survey now by following this link: www.wjx.cn/jq/16523417.aspx）
提前感谢你的帮助！（Thank you in advance!)
Kimberley Curtin

UNIVERSITY OF ALBERTA

Senior Chinese International Students!

(3rd/4th year)

高年级中国留学生！

You are invited to participate in a research study!

欢迎参加一项学术研究的问卷调查！

Please follow this link to complete a survey about health behaviours of university students:

请前往如下链接，完成一份关于大学生健康行为的问卷：

https://www.wjx.cn/jq/16523417.aspx

谢谢！ Thank you!

Facebook post:

Facebook recruitment post:

你是一名高年级（三年级或四年级）中国留学生吗？（Are you a senior Chinese international student (third or fourth year)?

如果你是，你被邀请参与一项关于中国留学生健康行为的学术研究。（If yes, you are invited to participate in a research study examining health behaviours of Chinese international students.）这个研究要求你完成一份 30 分钟左右的网络问卷。（You will be asked to complete a questionnaire online which will take approximately 30 minutes.）你的数据不仅将为大学提供关于中国留学生的宝贵信息，而且对于我的博士论文至关重要！（Your data provide valuable information to the University about the Chinese international students, and help me out with my PhD dissertation!)

更多信息请发邮件到我（Kim）的邮箱 kcurtin@ualberta.ca ！（Please contact Kim at kcurtin@ualberta.ca for more information!）或者，你可以前往这个链接，开始回答问卷：这里是链接（Or you can begin the survey by going to this link: LINK HERE）