The Thesis Committee for Rulan Shangguan

Certifies that this is the approved version of the following thesis:

Leisure Time Exercise Behavior and Motives of University Administrators in China

APPROVED BY

SUPERVISING COMMITTEE:

Supervisor:

(Xiaofen Keating)

(Dorothy Lambdin)

Leisure Time Exercise Behavior and Motives of University Administrators in China

by

Rulan Shangguan, B.S.; M.S.

Thesis

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Master of Arts

The University of Texas at Austin

August 2012

Acknowledgements

This thesis would not have been possible without the guidance and the help of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this study.

First and foremost, I would like to express my utmost gratitude to my thesis advisor Dr. Xiaofen Keating, whose sincerity and encouragement I will never forget, for her motivation and inspiration as I hurdle all the obstacles in the completion of my study.

Dr. Dorothy Lambdin, my thesis reviewer, an enthusiastic professor in physical education, has offered greatest help in my professional training and development, as well as insightful comments on my work.

My sincere thanks also go to Dr. Louis Harrison, Dr. Darla Castelli, for leading me working on diverse exciting projects and offering great opportunities in their groups.

I thank my Chinese colleagues Ms. Mingying Deng, Ms. Mengmeng Deng, Mr. Yong Huang for their hard work on data collection and input.

Last but not least, I owe my deepest gratitude to my family, without whose support I would not be able to accomplish my study and have such a wonderful life.

Abstract

Leisure Time Exercise Behavior and Motives of University Administrators in China

Rulan Shangguan, M.A.

The University of Texas at Austin, 2012

Supervisor: Xiaofen Keating

Background: University administrator physical activity (PA) attitudes and actions may play an important role in student fitness promotion on campus but have been given little attention. Guided by the Theory of Planned Behavior (TPB), this study explored the relationships of factors that influence Chinese university administrator PA behaviors.

Methods: A survey was designed to collect information regarding participants' PA behaviors, intentions, perceived health, body mass index (BMI) and common demographic factors. A total of 474 Chinese university administrators participated in this study with 443 completed surveys. Path analysis was used to test the predictive and mediational role of the aforementioned variables on total PA.

Results: Results revealed a good model fit. Attitudes mediated the effects of BMI and perceived health on total PA; subjective norms and self-efficacy had significant direct effects and mediated the effects of satisfaction and attitudes on total PA. The effects of

intentions on total PA were not significant.

Conclusions: Chinese university administrator PA behaviors were significantly influenced by attitudes, subjective norms, self-efficacy, BMI, perceived health and satisfaction with exercise facilities. The non-significant effects of intention on PA participation were not expected. More studies on university administrator's PA are needed in the future.

Table of Contents

List of Tables

List of Figures

Chapter One

Introduction

An overwhelming body of research has suggested that participation in PA on a regular basis is an important factor in maintaining sound health (Brown, Balluz, Heath, Moriarty, Ford, Giles, & Mokdad, 2003; U.S. Department of Health and Human Services [USDHHS], 2008). Many researchers and practitioners, however, remain puzzled by the fact that physical inactivity remains a significant public health problem despite numerous efforts to increase PA on a regular basis at all societal levels (Keating et al., 2011; Spence & Less, 2003). Enhancing PA in the general population remains an important public health challenge (Keating et al., 2005; Mokdad et al., 2001; USDHHS, 2008).

Evidence suggests that the modern working and living environments have seriously limited the amount of PA individuals can possibly accumulate (King, Bauman, & Calfas, 2002; Orleans, Kraft, Marx, & McGinnis, 2003; Saelens, Sallis, & Frank, 2003),resulting in the dramatic increase of overweight and obese individuals with higher risks for poor health (USDHHS, 2001). Therefore, there is an urgent need to promote PA in the general population.

The university campus is a unique work environment, typically equipped with fitness facilities and featuring established health, nutrition, and kinesiology programs. As a result, university settings have great potential to help improve administrators' PA through use of existing facilities and manpower. University administrators are essential to the operation of any institution of higher education (Gentry, Katz, & McKeeters, 2009)

including the health-related aspects of the institutional environment and so their attitudes and practices related to PA are of concern. However, few studies on this topic have been reported in the literature. The lack of research related to university administrators and PA is surprising considering its potential benefits for all individuals on campus. Moreover, unlike many other settings, university campuses share many commonalities such as the physical structure, the personnel characteristics, and formats for course scheduling, resulting a much higher potential generalizability of research findings than studies in other settings.

Significance. This research investigated how individual's PA intention and behavior are shaped by individual, social and environmental factors. This information provides a more comprehensive understanding about the relationship of these factors to PA intention and behavior among Chinese university administrators. This understanding could help guide the design and implementation of effective interventions for influencing the PA intention and behavior of university administrators.

Research Question. First, the present study aimed to assess Chinese university administrators' leisure time PA (exercise) level; and second, the study investigated direct and indirect factors influencing administrators' PA intention and behavior.

Hypothesis. We hypothesized that (a) the majority (i.e., more than 80%) Chinese university administrators' total PA level was not adequate to maintain sound health; (b) their PA behavior is influenced by sociodemographic factors such gender, BMI, and perceived health; (c) attitude, subjective norms and self-efficacy together predict Chinese

university administrators' intention to participate in PA and so ultimately determine their total amount of leisure time PA.

Chapter Two

Literature Review

The purposes of the project aimed to examine university administrators' PA and their PA determinants using a survey to collect the data in China. Thus, the literature review originally focused on university administrator PA. A thorough literature examination, however, indicated that few studies on the topic were available. Furthermore, no PA research using samples from the university administrator population in China has been reported. Neither were any studies found for administrator's PA in general. Therefore, an extended literature review on adult PA and determinants was conducted in order to shed light on issues related to the topic of the project. To date, a large number of studies on adult PA have been conducted. As a result, the literature review was limited to studies conducted since 2000 to represent the most recent research on the topic. The following three databases were searched: EBSCOhost, Pubmed, and Google scholar. The literature review began with an overview of previous studies on adult PA, followed by research on the theory that guided the design of the study, and ended with information about devices and procedures for collecting PA data among adults.

Findings concerning adult PA

Adult PA has caught the attention of researchers globally, evidenced by the fact that studies on the topic have been conducted in many countries including the US, Canada, Sweden, Japan, and China. With slight differences, various countries have developed their own cut-off value of recommended PA for adults (Pan et al., 2009;

Shibata, Oka, Nakamura, & Muraoka, 2009; USDHHS, 2008). While studies have explored healthy adult PA in many countries, the results vary greatly and certainly may not represent the actual phenomena in these countries due to the sampling limitations. However, the findings provide baseline data regarding adult PA in general. For example, it has been found that about 36% to 65% of adults had low to somewhat low PA in the US (Brock et al., 2009; Ham, Kruger, & Tudor-Locke, 2009; Tucker, Gregory, Welk, & Beyler, 2011; Sisson et al., 2012). A study done in Sweden reported that about two thirds of the sample were physically active (Bergman, Grjibovski, Hagströmer, Bauman, & Sjöström, 2008). About 50-80% of sampled individuals engaged in adequate amount of PA in Canada (Pan et al., 2009) while about 70% of adult Japanese did not meet the recommended amount of PA (Shibata et al., 2009).

Regarding Chinese adult PA, in spite of the decline of PA by age that was found (Ng, Norton, & Popkin, 2009), no studies have compared actual adult PA with the recommended amount of PA to classify people who are sedentary. For instance, Peters and colleagues (Peters et al., 2010) only reported the mean daily minutes of being physically active, generating limited usable data. Decreases of PA have been reported in occupational, transportation and household activity (Bauman, Allman-Farinelli, Huxley, & James, 2008), among which, occupational activity has been a major source of PA (Bell, Ge, & Popkin, 2001). According to the China Health and Nutrition Survey (CHNS), the occupational and household PA decreased due to the societal shift towards sedentary lifestyles and leisure time PA remained low with only a slight increase (Ng, Norton, &

Popkin, 2009). Fewer than 10% of Chinese adults report participating in any leisure time PA at all (Monda, Gordon-Larsen, Stevens, & Popkin, 2006).

PA Determinants

A number of studies have suggested that PA patterns are determined by personal, social, and environmental factors (Giles-Corti & Donovan, 2002a; Martinez et al., 2012; Pan et al., 2009; Wendel-Vos, Droomers, Kremers, Brug, & van Lenthe, 2007). The commonly examined personal determinants are gender, age, education level, and ethnicity (Pan et al., 2009; Shibata et al., 2009). To date, social and environmental factors are less studied in comparison with demographic variables. The most often investigated social factor is social support (Spanier & Allison, 2001; Wendel-Vos et al., 2007). Regarding environmental determinants, research has clustered around proximity to exercise facilities (Humpel, Owen, & Leslie 2002; Owen, Humpel, Leslie, Bauman, & Sallis, 2004; Wendel-Vos et al., 2007).

Gender. Gender is one of the most commonly examined demographic variables. Studies have indicated no gender difference in regard to PA intentions (Wankel & Mummery, 1993; Wankel, Mummery, Stephens, & Craig, 1994). Contradicting the intention results, the majority of research has found that males were more active than females (Pan et al., 2009; Trucker et al., 2011). Gender differences also have been found in factors in a health promotion model (Pender et al. 2006). Males had higher self-efficacy and perceived greater benefits and perceived lower barriers than females (Lee, 2005; Resnick, 2001; Shin & Jang, 2000).

BMI. One way to test adiposity rate is to compare the body's lipid amount with the overall body weight. BMI (weight in kilograms divided by the square of height in meters) is widely used to measure general adiposity and recommended by the World Health Organization (WHO) (2006). According to the WHO, BMI is used to classify individuals as underweight (≤20), acceptable weight (20<BMI≤25), overweight (25<BMI≤30), and obese (>30). Lahti-Koski et al. (2002) observed a strong inverse association of PA with obesity and BMI, regardless of the measurement used. Other studies have confirmed that PA level is negatively associated with BMI and this relationship is even stronger in obese individuals than non-obese individuals (Dwyer et al., 2007; Hemmingsson & Ekelund, 2007; Krum, Dessieux, & Thompson, 2006; Thompson, Rakow & Perdue, 2004; Tudor-Locke et al., 2001). Physical inactivity may be a result of fatness rather than simply its cause. This reverse causality may explain the consistent failure in attempts to reduce childhood obesity by promoting PA (Metcalf et al., 2011).

Educational level. Individuals with higher education level tend to be more physically active (Pan et al., 2009). A positive relationship between the educational level and the level of PA in adults has been reported (Trost et al., 2002). Moreover, the possible benefits of education that indirectly affect PA level include better job opportunities, higher SES, improved housing, more access to nutritious foods and better health insurance; direct effects of education on PA level come through greater health knowledge acquired from education and personal empowerment and self-efficacy (Baker et al., 2007).

Self-efficacy and Social Support. Self-efficacy and social support are two of the strongest and the most consistent correlates of PA participation across populations (Luszczynska & Schwarzer, 2005). Self-efficacy refers to "beliefs about one's capability to organize and execute the courses of action required to produce given attainments" (Bandura, 1986, 1997). Perceived self-efficacy operates as a determinant of an individual's behavioral intention and actual behavior and plays a crucial role in the initiation of new behaviors and in changing old habits. Self-efficacy is one of the factors studied most often in health behavior research (Luszczynska & Schwarzer, 2005), is the strongest predictor of PA in most studies, and has been reported to have a central role for individuals across age, gender, and ethnic groups. Research has suggested that participants who had a sufficiently high level of exercise self-efficacy successfully acted upon their plans, while those who doubted their capacity to act failed (Gutiérrez-Doña, Lippke, Renner, Kwon, & Schwarzer, 2009).

In a model suggested by Uchino (2006), social support ultimately encourages individuals to initiate and maintain leisure-time PA through psychological processes including motivation and self-efficacy. Another model of social support influence includes providing health information, and material resources such as access to exercising facilities (Uchino, 2006).

Environmental factors. Understanding the effect that environmental factors have on PA behaviors is an area of recent interest and there has been important research examining neighborhood effects on the PA patterns of both adults and children (Craig, Brownson, Cragg, & Dunn, 2002; Diez Roux, 2003; Duncan, Duncan, Strycker, &

Chaumeton, 2002; Humpel, Owen, & Leslie, 2002; Ross, 2000). A number of studies have identified several underlying environmental factors that have been associated with PA participation, including but not limited to, access to facilities, neighborhood safety, seasonal climate, street traffic, presence of sidewalks, area aesthetics, and dispersion of amenities (MacDougall et al., 1997; Booth et al., 2000; King et al., 2000; Ross, 2000; Wilcox et al., 2000).

Application of the Theory of Planned Behavior to PA

Developed from the Theory of Reasoned Action (Fishbein & Ajzen, 1975), the Theory of Planned Behavior notes that the intention to perform or not to perform a behavior determines the occurrence of the behavior. Intention is controlled by attitude toward the behavior, the subjective norm (perceptions of social pressure to perform the behavior), and perceived behavioral control (perceived ability to perform the behavior). The Theory of Planned Behavior has been used to provide guidance in PA research (Courneya, Friedenreich, Sela, Quinney, & Rhodes, 2002; Godin, 1993; Hagger, Chatzisarantis, & Biddle, 2002; Harland, Staats & Wilke, 1999; Jackson, Smith, & Conner, 2003; Kerner, 2003; Rosemary, McEachan, & Myers, 2010). In a recent meta-analytic review of 79 studies by Hagger et al. (2002), the Theory of Planned Behavior accounted for 44.5% of the variance in PA intentions and 27.4% of the variance in PA behavior.

Measures and Dosage of Exercise/PA to Accrue Health Benefits

Measures. The accurate measurement of PA is challenging because the activity patterns are complex and multi-dimensional, making it difficult to interpret or compare

reported data in PA using different measurements. Activity-specific energy expenditure values, expressed in metabolic equivalents (METS) or kilocalories (kcals) are commonly used to estimate the total energy expenditure from all activities and/or categories of activities. One MET is considered to represent resting energy expenditure, or approximately 3.5 ml/kg/min in terms of oxygen consumption. The criterion of 6 METS is used as a cutoff for vigorous PA (Welk, 2001). Another measurement of PA is time in moderate and vigorous intensity PA (MVPA), which is usually used to track individual participants' PA levels in an intervention or to associate personal attribute or physiologic outcomes with PA (Corder et al., 2009). Total steps per day could be a useful indicator of the accumulation of daily moderate activity (Bassett, Cureton, & Ainsworth, 2000; Welk et al., 2000). A study by Welk et al. (2000) provided empirical evidence of the usefulness of a 10,000-step count as an appropriate behavioral target.

Dosage. Exercise dosage consists of intensity, duration, and frequency of exercise and can also be reflected by total energy exertion (ACSM, 1998). The appropriate dosage of exercise/PA for maintaining sound health has been argued for years, and has been changed over time. The USDHHS (2008) has most recently suggested 150 minutes of PA or 700 kcals/week, rather than 30 minutes of moderate-intensity PA on 5 days per week. The significant change in recommended amounts of PA followed the reasoning that the intensity of PA is not as important as the total amount of PA.

Methods of Measuring PA

Self-report methods. There are two basic types of self-report on PA including (a) a general questionnaire that obtains overall estimates of activity, and (b) a daily log

survey that records participation in specific types of activities over 24 hours. The first type of surveys is used most often in order to assess PA patterns based on average daily activity. One often-used general questionnaire is the recently updated Behavior Risk Factor Surveillance System (BFRSS) survey (Ainsworth et al., 2000b), which can assess the intensity of reported activities using the corresponding code for the specific activity according to the "Compendium of Physical Activities - PA Index" (PAI). It is organized by activity type and allows for a detailed description of the form and intensity of regular exercise as well as an overall measure of daily PA, which includes occupational activity and normal daily routine. All commonly performed activities are assigned an intensity unit based on their rate of energy expenditure expressed as METs. The intensity of activities is classified as multiples of one MET or the ratio of the associated metabolic rate for the specific activity to the resting metabolic rate (RMR). By multiplying an individual's body weight by the MET value (listed in the PAI and duration of activity), it is possible to estimate metabolic activity in units of kilocalories (kcal).

Another activity measurement allows for the incorporation of three important parameters of exercise dosage (i.e., type of activity, duration, and intensity) into one aggregate measure, creating the possibility of comparing total PA level among all participants. A modified version of the Leisure-Time Exercise Questionnaire (LTEQ) has been used successfully across diverse populations and has a reported test-retest reliability in adults of .74 (Pereira et al., 1997). The LTEQ (Godin & Shephard, 1985) is a one-week instrument that assesses light, moderate, and vigorous exercise separately and creates a summary score by combining all three of these intensity levels. Participants are

asked to estimate times of each activity during a typical week. The total PA score is obtained by multiplying each level by the METs respectively (light = 3, moderate = 5, vigorous = 9). Higher scores indicate higher levels of total leisure time PA. The survey has been validated in a Chinese population with acceptable reliability and validity (Keating et al., 2005).

Objective measurement. New technologies have been used to assess PA objectively. To date, three kinds of devices have been validated: (a) pedometers; (b) accelerometers, and (c) heart rate monitors. Pedometers measure the number of steps taken. Total distance can be calculated by measuring stride length. Studies have shown that the use of a pedometer is associated with significant increases in PA and significant decreases in BMI (i.e., Bravata et al., 2007; Hultquist et al., 2005; Izawa et al., 2005; Moreau et al., 2001). Accelerometers are either one-dimensional or triaxial. One-dimensional accelerometers measure one direction of movement such as vertical movement of the trunk. Triaxial accelerometers measure vertical, anterior/posterior, and lateral movement. Heart rate monitors are effective for measuring vigorous PA. They are less effective for light and moderate intensity activities because heart rate may rise due to other factors, such as stress (Allor & Pivarnik, 2001; Freedson & Miller, 2000; LaMonte, Ainsworth, & Tudor-Locke, 2003).

Chapter Three

Methods

Participants

All participants were University administrators in China randomly selected from various universities across the entire country. The employment titles included president, vice president, dean, vice dean, director, vice director, department head, vice department head, and other officers. Among 474 returned surveys, 443 were complete at the criteria level and included in the data analysis. The average age was 47.83 (SD = 5.32).

Measures

Demographic Characteristics. Participants were asked to report their demographic information including age, gender, height (in centimeters), weight (in kilograms), marital status, employment title, education and perceived health status. BMI was calculated using the following formula: BMI = weight (kg)/height $(m)^2$. Perceived health was reported as one of 5 options representing ordinal levels of health from poor to excellent.

Satisfaction. In addition to the demographic information in the first part of the survey, community exercise facility satisfaction was measured in a single question with 5 different options, which represented 5 levels of satisfaction with 1 as poor and 5 as excellent.

Theory of Planned Behavior Correlates. The second part of the survey was an independent questionnaire designed to assess the 4 components of TPB. Participants were asked to assess their attitudes towards PA, subjective norms related to PA, self-efficacy

related to PA and intentions to participate in PA on a 1-7 Likert scale (for better precisions) with 1 as strongly disagree and 7 as strongly agree. Four questions were asked for each correlate, within which at least one was reverse worded to ensure the validity of the answers.

PA. Participants were asked to report their weekly PA in terms of the type, intensity, duration and frequency of the activities they engaged in. Participants were asked: " During the last 7 days, how many times did you do light/moderate/vigorous PA in your leisure time for at least 30 minutes?" Total leisure time PA score were calculated using the following formula: Total PA score = (Times of Light PA)*3 + (Times of Moderate PA)*5 + (Times of Vigorous PA)*9 (Godin & Shephard, 1985).

Data Collection

A paper-based survey was distributed by our Chinese colleagues throughout a 4-month period in 2011. An individual from each university was contacted and asked to distribute the questionnaires to potential participants. Responses were collected by the same individual and then sent back to our primary contacts in China. All information was entered into an electronic spreadsheet.

Statistical Analyses

Data screening was first conducted. Cases with more than 50% missing values were deleted. Assumptions for path analysis were checked. Then descriptive analyses were performed. A model for total leisure time PA based upon Theory Planned Behavior was developed (see Figure 1) to explore relationships between individual, social, and environmental correlates of PA by means of path analysis. The overall model fit for the

final model (see Figure 2) was determined using chi-square, with a p value > .05. According to Meyers and colleagues (Meyers et al., 2006), model fit indices should include normed fit index (NFI) and comparative fit index (CFI), and root mean square error of approximation (RMSEA) (Meyers et al., 2006). For NFI and CFI, the acceptable value needs to be greater than .90 while the magnitude of RMSEA needs to be smaller than .05 in order to be acceptable. The full data set from this population was limited to those participants who had completed responses for the dependent variable (total PA) and all 19 independent variables. All analyses were done using SPSS version 20 and Amos version 19. Significance level was set at p value at < .05. Descriptive data were generated for all variables, and t-tests were conducted to test gender differences in all variables.

Chapter Four

Results

Descriptive Data

Study sample characteristics are summarized with means and standard deviations in Table 1. Participants were predominantly male (83.30%), and on average 47.83 years old. Overall means of satisfaction, perceived health were above the neutral on the 1-5 Likert scale, and means for all the TPB measures were also above the neutral level on the 1-7 Likert scalse. The BMI value of all participants was 24.74 ± 2.16, indicating an average weight near the upper level of optimal BMI range. BMI for males (25.02 ± 2.11) was significantly higher ($p < .05$) than females (23.30 ± 1.80). Males also felt more satisfied ($p < .05$) with the community exercise facilities (3.45 ± .87, on a scale from 1-5) than females (3.21 ± .65). Females had significantly greater ($p < .05$) perceived health (4.81 ± .63, on a scale from 1-5) than males (3.88 ± .66), and had higher ($p < .05$) positive attitudes towards PA (6.70 ± .53) than males (6.50 ± .60).

Overall PA results by demographic variables are summarized in Table 2, including means, standard deviations and sample sizes. The majority of our participants had engaged in college sports, and nearly half (48.08%) of them had regularly exercised in college. Over half (56.43%) of the participants had acceptable weights based on BMI, and 41.53% and 1.13% were overweight or obese respectively. Participants with higher BMI reported higher level of total PA, the differences were not significant between underweight and acceptable weight participants, nor between acceptable weight and overweight participants. More than half (59.82%) responses on perceived health were

"Good", and none of them reported perceived health as "Poor". Those who perceived themselves as very healthy reported a significantly lower amount of total leisure time PA than any of the other groups.

Path Analysis

The final model (Figure 2) showed relationships between individual, social, and environmental factors and total leisure time PA (χ^2= 22.057, $p > .05$; CFI = .970, NFI = .933, RMSEA = .040).

Attitudes, BMI and perceived health affected total PA directly and indirectly ($p < .05$), indicating participants with better attitudes towards PA, lower perceived health and higher BMI reported higher levels of leisure time PA. Attitudes mediated the effects of BMI and perceived health on total PA, indicating participants with better attitudes had lower BMI and greater perceived health. BMI also affected total PA indirectly through its relationship to self-efficacy, which means participants with higher BMI were more likely to have greater self-efficacy to participate in leisure time PA. Subjective norms and self-efficacy had significant direct effects ($p < .05$) on total PA; and mediated the effects ($p < .05$) of facility satisfaction and attitudes on total PA ($p < .05$). Higher self-efficacy was positively related to PA while subjective norms were negatively related to PA. Attitudes, subjective norms, and self-efficacy all had direct and significant effects on PA intentions ($p < .05$). However, no significant effects of intentions on total leisure time PA were observed ($p > .05$). Table 3 includes the results of the path analysis in more detail.

Chapter Five

Discussion

This study provided empirical evidence and used Theory of Planned Behavior correlates to conceptualize and examine the effects of individual, social and environmental level factors on the leisure time PA of Chinese university administrators. The data from the study supported our hypothesis that university administrators' behavioral PA intentions were shaped by attitudes, subjective norms, and self-efficacy. In addition, individual factors (i.e., BMI, perceived health, attitudes, and self-efficacy), social factors (i.e., subjective norms as social support from families and friends), and an environmental factor (i.e., satisfaction of exercise facilities) predicted the total amount of leisure time PA. These factors affected each other on different levels.

Gender. Although many studies have reported lower rates of PA participation in women than in men (Grzywacz & Marks, 2001, Grubbs & Carter, 2002, Lee, 2005, Ammouri et al. 2007); and a series of local studies in Hong Kong have revealed women were less physically active than men (Centre for Health Protection [CHP], 2005; Hong Kong Sports Institute [HKSI], 2000, 2001, 2002; Hui & Morrow, 2001; Population Health Survey, 2004); this study found no difference on total leisure time PA between men and women. This might be due to the differences of the target populations in previous studies and the unequal sample size of male and female participants in the present study (there are more male than female members in the population being sampled, Chinese university administrators). A primary barrier to PA participation in women is a lack of time due to work and/or family commitments (Heesch, Brown, &

Blanton, 2000; Zhu, Timm, & Ainsworth, 2001); however, this did not appear to cause much difference among participants in the present study perhaps because they have more similar responsibilities at work than in other populations.

BMI, perceived health, PA attitudes and satisfaction of facilities were found to be different between genders. Although the overall average BMI was below 25, men had a higher average BMI than women in the present study. This result may be explained by a previous report suggesting that BMI is gender dependent when used as an indicator of body fatness in adults (Gallagher et al., 1996). Overweight or obesity emerged as a consistent negative influence on PA in previous studies (Brownson et al., 2000; Salmon et al., 2000). Contrary to previous findings, results of the present study showed a positive effect of BMI on total PA, indicating a higher level of participation of leisure time exercise among participants with higher BMI. This might be due to their concern about having the potential to be obese. The average perceived health for women was greater than the average perceived better health than men. One possible reason could be difference in alcohol consumption between two genders, although not measured in this survey. As an integral part of and with a long history in Chinese culture, alcohol is commonly consumed, particularly by men, as part of business dinners for the purpose of good relationships between supervisors and employees, as well as camaraderie among colleagues (Liu, 1995, Hao et al., 1995, 1999). Information regarding university administrators' alcohol use should be included in future studies in order to examine alcohol influence on perceived health and on PA behavior.

Perceived health. Results from path analysis suggested a positive influence of

perceived health on PA attitudes, while PA attitudes are a positive predictor of total PA. Therefore, one would expect a positive relationship between perceived health and total PA. Interestingly, perceived health had a negative influence on total PA, which is in contrast to what would be expected. This finding may suggest that those who perceived not having a health problem might not prioritize PA due to their satisfaction with their own health.

Attitudes. PA attitudes including appreciation of health-fitness benefits and enjoyment of activities were found to be higher in women and to positively influence total PA, paralleling the findings consistently obtained from previous studies which have shown that the two most important reasons for women participating in PA were fitness and health benefits (Heesch et al., 2000; HKSI, 2000, 2001, 2002; Segar, Jayaratne, Hanlon, & Richardson, 2002; Wilson et al., 2002). Satisfaction with facilities was the only correlate found to be higher in men than in women, which might compensate for the other correlates to maintain the equal amounts of PA between men and women.

The TPB model of total PA. Although previous studies (Courneya, Bobick, & Schinke, 1999; Courneya, Plotnikoff, & Birkett, 2000; Kerner & Grossman, 1998; Michels, 1998) provided relatively weak support for constructs from TPB, this study proposed a TPB model (Figure 1) and empirically tested the model and provided concrete support (Figure 2). Given that no previous research has used the TPB model to examine Chinese university administrators' PA levels, this study marks the first attempt to holistically examine various factors influencing their PA. Several insightful results can be summarized from this study and are presented below.

First, we found that the TPB constructs could be regarded as different categories of factors that have influence on individuals' PA behavior. Attitudes could be regarded as individual factors together with BMI, perceived health and self-efficacy. Subjective norms which included items regarding caring and concerns from families and friends could be seen as social factors. Satisfaction with facilities could be deemed, an environmental factor that affected PA participation of university administrators.

Second, attitudes, subjective norms and self-efficacy all had significant positive influences on PA intentions, which is consistent with previous findings using TPB as a framework (Rosemary, McEachan, & Myers, 2010). In particular, self-efficacy had the greatest effect on intentions. Similar findings have been reported by Sternfeld et al. (1999) in a study investigating PA participation in women. Unexpectedly, no effects of intentions on PA behavior were observed, which is contrary to the TPB model that proposed a positive relationship between behavioral intentions and actual behaviors (Chatzisarantis & Hagger, 2005; Hagger, Chatzisarantis, & Biddle, 2002). This might be due to lack of motivation and skills needed for maintaining regular exercising behavior. Another possible explanation is that the TPB solely focuses on the decisional phase of motivation, disregarding the impact of the post-decisional phase on behaviors. Caution needs to be exercised when generalizing these results, as this is a survey study.

Third, in spite of finding no effects of PA intentions on behaviors, we confirmed the influences of attitudes, subjective norms and self-efficacy on total PA behavior. This means university administrators' PA behaviors were less likely to be influenced by their PA intentions, but more likely to be predicted by individual, social and environmental

factors.

Fourth, in contrast to previous studies (Courneya, Bobick, & Schinke, 1999; Courneya, Plotnikoff, & Birkett, 2000; Kerner & Grossman, 1998; Michels, 1998) that found no associations between attitudes and PA behaviors, results from this study suggested that attitudes played an important role in determining a person's PA intentions and behaviors. This was not a direct effect, but occurred through influences on subjective norms and self-efficacy. Therefore, changing university administrators' health beliefs and attitudes toward active life styles may be an effective way to promote PA in college, as policies, opportunities and facilities regarding student's PA are highly dependent on administrators beliefs.

Fifth, satisfaction with recreational facilities as the only environmental factor examined in this study contribute a considerable part to university administrators' PA behaviors, helping it emerge as a crucial predictor of PA participation in large populations (Booth et al., 2000; King et al., 2000; MacDougall et al., 1997). Although the effect of this factor is found to be indirect in this study, satisfaction has significant positive influences on self-efficacy and subjective norms. This provides an important implication for future campus design and construction. Making recreational facilities and exercise equipment accessible and enjoyable to the majority of the population on campus might increase the possibility of individuals participate in PA because of higher level of self-efficacy and more positive subjective norms.

In addition, in absence of significant influence of sociodemographic factors on total PA found in this study is different from previous studies that showed age, marital

status and education influenced the PA of men (Yang et al., 2005). The possible explanation may be the unique population in this study; the majorities of our participants had relatively high educational level and were married, living with their spouses. Future studies using a larger sample with more variance of the aforementioned sociodemographic factors are needed.

This study has some limitations. First, PA level was measured by recalling one's PA in a self-reported survey, making the results not as valid as objectively measured PA. Second, the results of gender differences might be biased due to the unequal gender proportions of the sample. Gender disparity in PA should be controlled before generating conclusions from this particular sample to its populations. Third, only one environmental factor was investigated in this study. More detailed and specific questions should be designed to examine the environmental influences on participants' PA behaviors.

Despite the above limitations, this study is the first to focus on university administrators' PA determinants and behaviors. This work may have important implications for campus wide health and PA programs since administrators' personal attitudes and behaviors related to PA may influence their decisions about campus policies related to PA. Understanding factors that influence administrators' PA behaviors could provide guidance for interventions that increase their own involvement in PA. These ideas may also contribute to health promotion programs in other institutions and organizations.

Table 1 Descriptive Statistics of Chinese University Administrator Total Leisure Time Physical Activity (N=443)

	Total Sample	Male	Female
Sample Size	443	369 (83.30%)	74 (16.70%)
Age	47.83 (5.32)	47.98 (5.49)	47.05 (4.30)
BMI [a]	24.74 (2.16)	25.02 (2.11)*	23.30 (1.80)*
Perceived Heath [b]	3.93 (.67)	3.88 (.66)*	4.81 (.63)*
Facility Satisfaction [b]	3.41 (.84)	3.45 (.87)*	3.21 (.65)*
Attitudes [c]	6.53 (.59)	6.50 (.60)*	6.70 (.53)*
Subjective Norms [c]	5.21 (.98)	5.20 (.93)	5.29 (1.20)
Self-efficacy [c]	5.23 (.98)	5.25 (.92)	5.14 (1.26)
Intentions [c]	4.90 (.59)	4.89 (.59)	4.97 (.60)
Total PA [d]	21.25 (14.59)	21.16 (15.12)	21.66 (11.68)

a. BMI indicates body mass index, was calculated by formula: $kg/(m)^2$

b. Perceived Health and Satisfaction with exercise facilities ranged from 1 to 5, with a higher score indicating a greater extent.

c. Attitudes, Subjective Norms, Self-efficacy and Intentions scores ranged from 1 to 7, with a higher score indicating a greater extent.

d. Total PA was calculated by formula: (Light PA)*3+(Moderate PA)*5+(Vigorous PA)*9.

* t-test analyses significant at $p < .05$.

Table 2 Overall PA Results by Demographic Variables (N=443)

Demographic Variables		Mean	SD	N (%)
Gender	Female	21.66	11.68	74 (16.70%)
	Male	21.16	15.12	369 (83.30%)
College Sports History	Never	23.14 [ab]	12.06	37 (8.35%)
	Sometimes	19.36 [a]	15.49	193 (43.57%)
	Always	22.62 [b]	14.01	213 (48.08%)
BMI	<20	15 [a]	15.18	4 (9.03%)
	20-25	19.84 [ab]	14.66	250 (56.43%)
	25-30	22.95 [bc]	14.35	184 (41.53%)
	>30	34 [c]	8.22	5 (1.13%)
Perceived Health	Very Bad	-	-	0 (0%)
	Bad	27.85 [b]	18.60	7 (1.58%)
	Moderate	20.33 [b]	14.53	93 (20.99%)
	Good	23.13 [b]	15.34	265 (59.82)
	Very Good	15.35 [a]	9.15	78 (17.61)

* Means with different superscripts indicate significant differences at $p < .05$.

Table 3 Path Analysis Standardized Total Effects

Path	Standardized Total Effects	P value
BMI → Attitudes	-.184	**
BMI → Self-efficacy	.113	*
BMI → Total PA	.135	*
Perceived Health → Attitude	.157	**
Perceived Health → Total PA	-.122	*
Facility Satisfaction → Self-efficacy	.163	**
Facility Satisfaction → Subjective Norms	.254	**
PA Attitudes → Subjective Norms	.189	**
PA Attitudes → Self-efficacy	.306	**
PA Attitudes → Intentions	.195	**
PA Attitudes → Total PA	.118	*
Subjective Norms → Intentions	.168	**
Subjective Norms → Total PA	-.177	**
Self-efficacy → Intentions	.352	**
Self-efficacy → Total PA	.111	*

* Significant at .05 level, ** significant at the .01 level.

Figure 1 Proposed Model for Path Analysis

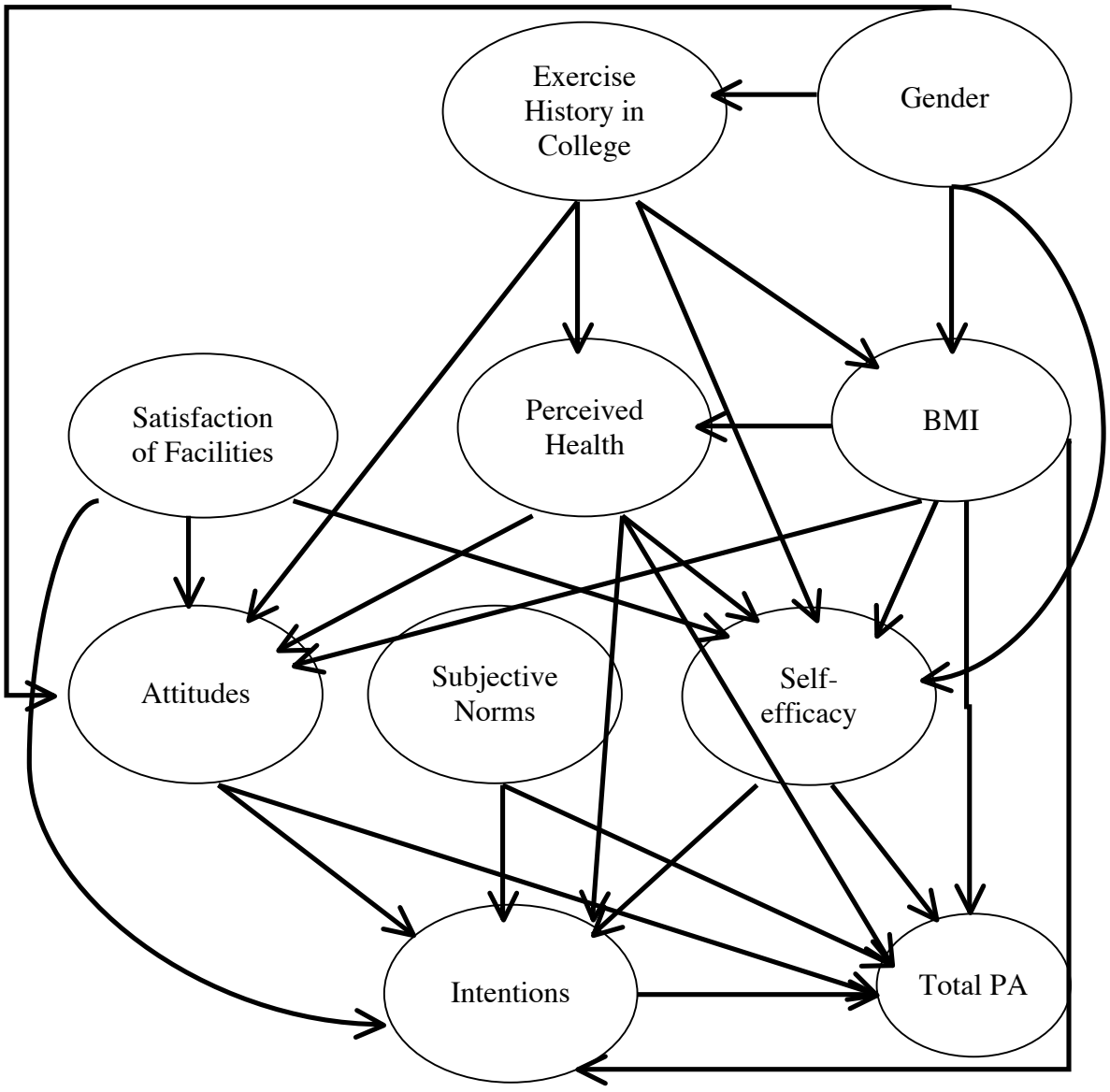
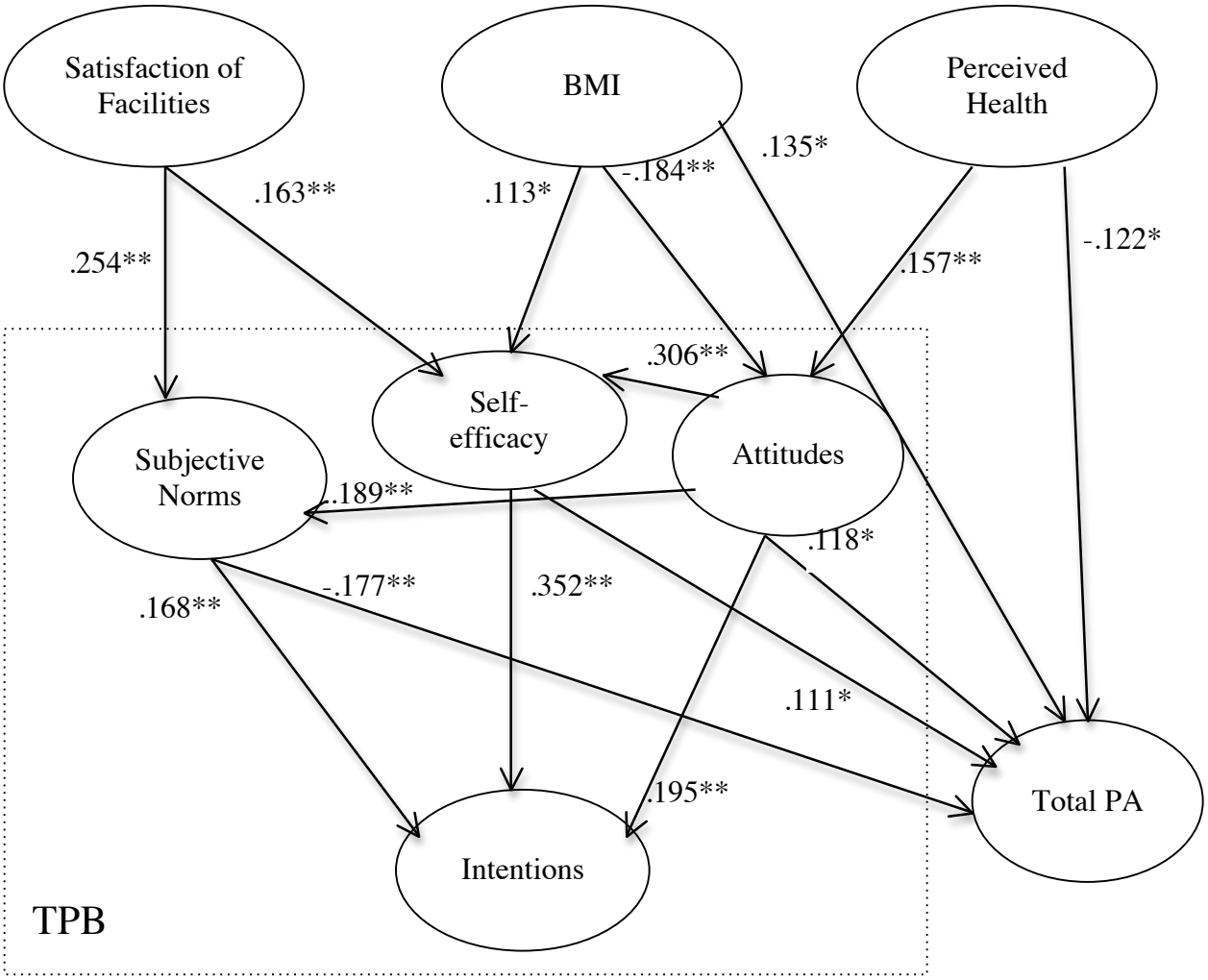


Figure 2 Modified Model for Path Analysis



Appendix

Survey for Chinese University Administrators Leisure Time Exercise

1. Age _____
2. Gender _____
3. Height _____cm Weight _____kg
4. How do you perceive your current health status? Pease check one.

   Poor Bad Neutral Good Excellent
5. How often did you participate in exercise/sports when you were in college? Please check one.

   Never Sometimes Always
6. How satisfactory do you think the overall exercise facilities in your community are? Please check one.

   Poor Bad Neutral Good Excellent
7. During the past 7 days, how many times did you do light/moderate/vigorous PA in your leisure time for at least 30 minutes?

Intensity	Activities (please indicate what activities you participated during the last 7 day period)	Times you participated in each activity for at least 30 mins
Vigorous	i.e. Running, Tennis/Badminton, Volleyball, Football, Basketball, Swimming, Aerobics, etc. Others_____	
Moderate	i.e. Fast Walking, Light Tennis/Badminton, Table Tennis, Strenth Training, Dancing, etc. Others_____	
Light	i.e. Walking, Yoga, Bowling, Golf, Fishing, etc. Others_____	

Theory of Planned Behavior Questionnair

Please check one answer according to your own situation.

1-Strongly Disagree

2-Disagree

3-Disagree Somewhat

4-Neutral

5-Agree Somewhat

6-Agree

7-Strongly Agree

1. I think appropriate physical activity/exercises are good for my fitness.
2. I think it is well worth the effort to exercise for my fitness.
3. I think exercising is a pleasant thing.
4. I think exercising is harmful.
5. Most of the people who are important to me think I should participate in physical activity/exercises.
6. Most of the people who are important to me would make fun of me participating in physica activity/exercises.
7. Most of the people who are important to me would like to participate in physica activity/exercises themselves.
8. Most of the people who are important to me do not care if I participate in physical activity/exercises.
9. It is easy for me to maintain a physically active lifestyle.

10. I could maintain a physically active lifestyle if I wanted to.

11. Participating in physical activity/exercises is entirely within my control.

12. I have the knowledge and ability to maintain a physically active life.

13. If I have the chance, I will participate in physical activity/exercises.

14. I'm not sure if I would participate in physical activity/exercises in the near future.

15. I decided to participate in physical activity/exercises regularly in the near future.

16. It is impossible for me to commit to participation in physical activity/exercises.

Bibliography

Allor, K.M. & Pivarnik, J.M. (2001). Stability and convergent validity of three physical activity assessments. *Medicine & Science in Sports and Exercise*, 33, 671-676.

Ammouri, A.A., Neuberger, G., Nashwan, A.J., & Al-Haj, A M. (2007). Determinants of self-reported physical activity among Jordanian adults. *Journal of Nursing Scholarship,* 39, 342–349.

Baker D.W., Wolf M.S., Feinglass J., Thompson J.A., Gazmararian J.A., & Huang J.(2007). Health literacy and mortality among elderly persons. *Archives of International Medicine,* 167(14), 1503-1509.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman.

Bassett, D. R., Cureton, A. L., & Ainsworth, B. E. (2000). Measurement of daily walking distance-questionnaire versus pedometer. *Medicine & Science in Sports & Exercise*, 32(5), 1018-1023.

Bauman A., Allman-Farinelli M., Huxley R., & James W.P.T. (2008). Leisure-time physical activity alone may not be a sufficient public health approach to prevent obesity–a focus on China. *Obesity Review,* 9(Suppl.1), 119-126.

Bell A.C., Ge, K., & Popkin, B.M. (2001). Weight gain and its predictors in Chinese adults. *International Journal of Obesity Related Metab Disorder,* 25(7), 1079-1086.

Bergman, P., Grjibovski, A.M., Hagströmer, M., Bauman, A., & Sjöström, M. (2008). Adherence to physical activity recommendations and the influence of socio-demographic correlates-a population-based cross-sectional study. *BMC Public Health,* 8, 367.

Booth, M.L., Owen, N., Bauman, A., Clavisi, O., & Leslie, E. (2000). Social-cognitive and perceived environment influences associated with physical activity in older Australians. *Preventive Medicine*, 31, 15-22.

Bravata, D.M., Smith-Spangler, C., Sundaram, V., Gienger, A.L., Lin, N., Lewis, R., Stave, C.D., Olkin, I., & Sirard, J.R. (2007). Using pedometers to increase physical activity and improve health: a systematic review. *Journal of American Medicine Association,* 298(19), 2296-2304.

Brock, D.W., Thomas, O., Cowan, D.D., Allison, D.B., Glenn A. Gaesser, G.A. et al., (2009). Association between insufficiently physically active and the prevalence of obesity in the United States. *Journal of Physical Activity & Health,* 6, 1-5.

Centre for Health Protection (2005). Hong Kong population health profile series. Retrieved June 5, 2006, from http://www.chp.gov.hk/epidemiology.asp?lang=en&id=360&pid=134&ppid=29S.

Chatzisarantis, N., & Hagger, M. S. (2005). Effects of a brief intervention based on the theory of planned behavior on physical activity participation. *Journal of Sport & Exercise Psychology*, 4, 34-45.

Chatzisarantis, N., & Hagger, M. S. (2008). Influences of personality traits and

continuation intentions on physical activity participation within the theory of planned behavior. (2008). Psychology & Health, 23(3), 347-367.
Corder K., van Sluijs, E.M.F., Wright, A., Whincup, P., Wareham, N.J., Ekelund, U. (2009). Is it possible to assess free-living physical activity and energy expenditure in young people by self-report? *American Journal of Clinical Nutrition,* 89, 862 70.
Couneya, K.S.,Bobick, T.M., & Schinke, R.J. (1999). Does the theory of planned behavior mediate the relation between personality and exercise behavior? *Basic & Applied Social Psychology*, 21, 317-324.
Courneya, K.S., Plotnikoff, R.C., Hotz, S.B., & Birkett, N.J. (2000). Social support and the theory of panned behavior in the exercise domain. *American Journal of Health Behavior*, 24, 300-308.
Craig, C. L., Brownson, R. C., Cragg, S. E., & Dunn, A. L. (2002). Exploring the effect of the environment on physical activity: A study examining walking to work. *American Journal of Preventive Medicine*, 23(Suppl.2), 36-43.
Diez Roux, A. V. (2004). Estimating neighborhood health effects: The challenges of causal inference in a complex world. *Social Science & Medicine*, 58(10), 1953-1960.
Duncan, S. C., Duncan, T. E., Strycker, L. A., & Chaumeton, N. R. (2002). Neighborhood physical activity opportunity: A multilevel contextual model. *Research Quarterly for Exercise & Sport,* 73(4), 457-463.
Freedson, P.S. & Miller, K. (2000). Objective monitoring of physical activity using motion sensors and heart rate. *Research Quarterly for Exercise & Sport*, 71, 21-29.
Fuller D, Sabiston C, Karp I, Barnett T, & O'Loughlin J. (2011). School sports opportunities influence physical activity in secondary school and beyond. *Journal of School Health*, 81, 449-454.
Gallagher, D., Visser, M., Sepulveda, D., Pierson, R.N., Harris, T., & Heymsfield, S.B. (1996). How useful is body mass index for comparison of body fatness across age, sex and ethnic groups? *American Journal of Epidemiology*, 143, 228-239.
Gentry, W.A., Katz, R.B., & McKeeters, B.B. (2009). The continual need for improvement to avoid derailment: a study of college and university administrators. *High Education Research & Development*, 28, 335-348.
Giles-Corti B, Donovan RJ. (2002a). The relative influence of individual, social and physical environment determinants of physical activity. *Social Science & Medicine,* 54, 1793-1812.
Giles-Corti B, Donovan RJ. (2002b). Socioeconomic status differences in recreational physical activity levels and real and perceived access to a supportive physical environment. *Preventive Medicine,* 35, 601-611.
Godin, G. & Shephard, R.J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Science*, 10, 141-146.

Grzywacz, J.G. & Marks, N.F. (2001). Social inequalities and exercise during adulthood: toward an ecological perspective. *Journal of Health & Social Behavior*, 42, 202–220.

Grubbs, L. & Carter, J. (2002). The relationship of perceived benefits and barriers to reported exercise behaviors in college undergraduates. *Family & Community Health,* 25, 76–84.

Gutiérrez-Doña, B., Lippke, S., Renner, B., Kwon, S., & Schwarzer, R. (2009). How selfefficacy and planning predict dietary behaviors in Costa Rican and South Korean women: A moderated mediation analysis. *Applied Psychology: Health and Well-Being*, 1, 91–104.

Ham, S.A., Kruger, J., & Tudor-Locke, C. (2009). Participation by US Adults in Sports, Exercise, and Recreational Physical Activities**.** *Journal of Physical Activity & Health* 6(1), 6-14.

Hagger, M., Chatzisarantis, N., & Biddle, S. (2002). A meta-analytic review of the theories of reasoned action and planned behavior: Predictive validity and the contribution of additional variables. *Journal of Sport & Exercise Psychology*, 24, 3-32.

Hao, W., Derson, Y., Xiao, S., Li, L., & Zhang, Y. (1999). Alcohol consumption and alcohol-related problems: Chinese experience from six area samples, 1994. *Addiction,* 94, 1467-1476.

Hao, W., Young, D.S., & He, M. (1995). Drinking in China: present situation, trends and counter-measures. *Chinese Journal of Clinical Psychology*, 3, 243-248.

Heesch, K. C., Brown, D. R., & Blanton, C. J. (2000). Perceived barriers to exercise and stage of exercise adoption in older women of different racial/ethnic groups. *Women&d Health*, 30, 61–76.

Hong Kong Sports Institute [HKSI]. (2000). Sports participation survey 1999. HKSI: Hong Kong.

Hong Kong Sports Institute [HKSI]. (2001). Sports participation survey 2000. HKSI: Hong Kong.

Hong Kong Sports Institute [HKSI]. (2002). Sports participation survey 2001. HKSI: Hong Kong.

Hui, S. S. C., & Morrow, J. R. (2001). Level of participation and knowledge of physical activity in Hong Kong Chinese adults and their association with age. *Journal of Aging & Physical Activity*, 9, 372–385.

Hultquist, C.N., Albright, C., & Thompson, D.L. (2005). Comparison of walking recommendations in previously inactive women. *Medicine & Science in Sports & Exercise*, 37(4), 676-683.

Humpel, N., Owen, N., Leslie, E. (2002). Environmental factors associated with adults' participation in physical activity: a review. *American Journal Preventive Medicine,* 22,188–199.

Izawa, K.P., Watanabe, S., Onvya, K., et al. (2005). Effect of the self-monitoring approach on exercise maintenance during cadiac rehabilitation: a randomized,

controlled trial. *American Journal of Physical Medicine & Rehabilitation*, 84(5), 313-321.

Keating, X.D., Guan, J., Haung, Y., Deng, M., Wu, J., & Qu, S. (2005). A cross-culture validation of the stages of exercise behavior change scale. *European Physical Education Review, 11*(1), 71-83.

Kerner, M.S. & Grossman, A.H. (1998). Attitude, social, and practical correlates to fitness behavior: attest of the theory of planned behavior. *Perceptual & Motor Skills*, 87, 1139-1154.

King, A.C., Castro, C., Wilcox, S., Eyler, A.A., Sallis, J.F., & Brownson, R.C. (2000). Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of US middle-aged and older aged adults. *Health Psychology*, 19(4), 354-64.

Krum, M.E., Dessieux, L.O., & Thompson, L.D. (2006). The relationship between daily steps and body compositions in postmenopausal women. *Journal of Women's Health*, 15, 202-210.

Lahti-Koski, M., Pietinen, P., Heliövaara, M., and Vartiainen, E. (2002). Associations of body mass index and obesity with physical activity, food choices, alcohol intake, and smoking in the 1982–1997 FINRISK Studies. *American Journal of Clinical Nutrition*, 75, 809-817.

LaMonte, M.J., Ainsworth, B.E., & Tudor-Locke, C. (2003). Assessment of physical activity and energy expenditure. In Anderson, R.E. (Eds.) *Obeisity: Etiology, Assessment, Treatment and Prevention*, Champaign, IL: Human Kinetics, 111 137.

Lee, Y. (2005). Gender differences in physical activity and walking among older adults. *Journal of Women & Aging,* 17, 55–70.

Liu, J. (1995). *Chinese Ancient Wine and Drinking*. Commercial Publishing House, Beijing.

Luszczynska, A., & Schwarzer, R. (2005). Social cognitive theory. In M. Conner & P. Norman (Eds.) *Predicting health behavior*, Buckingham: Open University Press, 127–169.

MacDougall, C., Cooke, R., Owen, N., Wilson, K., & Bauman, A. (1997). Relating physical activity to health status, social connections and community facilities. *Australian & New Zealand Journal of Public Health*, 21(6), 631-637.

Martinez, S.M., Guadalupe X. Ayala, G.X., Patrick, K, Arredondo, E.M., Roesch, S., & Elder, J. (2012). Associated pathways between neighborhood environment, community resource factors, and leisure-time physical activity among Mexican-American adults in San Diego, California. *American Journal of Health Promotion,* 26(5), 281-288.

Metcalf, B.S., Hosking, J., Jeffery, A.N., Voss, L.D., Henley, W., & Wilkin, T.J. (2011). Fatness leads to inactivity, but inactivity does not lead to fatness: a longitudinal study in children. *Archives of Disease in Childhood*, 96, 942-947.

Moreau, K.L., Degarmo, R., Langley, J., et al. (2001). Increasing daily walking lowers blood pressure in postmenopausal women. *Medicine & Science in Sports & Exercise,* 33(11), 1825-1831.

Meyers, L. S., Gamst, G., & Guarino, A. J. (2006). *Applied multivariate research*, London: Sage publications.

Michels, T.C. (1998). Predicting exercise in older Americans: using the theory of planned behavior. *Military Medicine*, 163, 524-529.

Monda, K.L., Gordon-Larsen, P., Stevens, J., & Popkin, B.M. (2006). China's transition: The effect of rapid urbanization on adult occupational physical activity. *Social Science & Medicine,* 64, 858-870.

Ng, S.W., Norton, E.C., Popkin, B.M. (2009). Why have physical activity levels declined among Chinese adults? Findings from the 1991-2006 China Health and Nutrition Surveys. *Social Science & Medicine*, 68(7), 1305-1314.

Owen, N., Humpel, N., Leslie, E., Bauman, A., & Sallis, J.F. (2004). Understanding environmental influences on walking: review and research agenda. *American Journal of Preventive Medicine,* 27(1), 67–76.

Pan, S.Y., Cameron, C., Desmeules, M., Morrison,H., Craig, C.L., & Jiang, X. (2009). Individual, social, environmental, and physical environmental correlates with physical activity among Canadians: A cross-sectional study. *BMC Public Health,* 9, 21.

Pender, N.J., Murdaugh, C.L. & Parsons, M.A. (2006). *Health Promotion in Nursing Practice*, New Jersey: Prentice Hall Health.

Pereira, M.A., FitzerGerald, S.J., Gregg, E.W., Joswiak, W.L., Suminski, R., Utter, A.C., & Zmuda, J. (1997). A collection of physical activity questionnaires for health-related research. *Medicine & Science in Sports & Exercise*, 29(Suppl.6), 1-205.

Peters, T.M., Moore, S.C., Xiang, Y.B., Yang, G., Shu, X.O., Ekelund, U., et al., (2010). Accelerometer-Measured Physical Activity in Chinese Adult**.** *American Journal of Preventive Medicine*, 38(6), 583–591.

Population Health Survey 2003/2004. (2004). Hong Kong SAR: Department of Health and Department of Community Medicine, The University of Hong Kong.

Resnick B. (2001). A prediction model of aerobic exercise in older adults living in a continuing-care retirement community. *Journal of Aging & Health,* 13, 287 310.

Rosemary, R.C., McEachan, S.S., & Myers, L. (2010). Mediation of personality influence on physical activity within the theory of planned behaviour. *Journal of Health Psychology*, 15, 1170-1180.

Ross, C. E. (2000). Walking, exercising, and smoking: Does neighborhood matter? *Social Science & Medicine,* 51(2), 265–274.

Sallis,J.F.,& Owen, N. (1999). *Physical Activity and Behavioral Medicine*: Thousand Oaks, California: Sage Publications.

Segar, M., Jayaratne, T., Hanlon, J., & Richardson, C. R. (2002). Fitting fitness into women's lives: Effects of a gender tailored physical activity intervention. *Women's Health Issues*, 12, 338–347.

Shibata, A., Oka, K., Nakamura, Y., & Muraoka, I. (2009). Prevalence and Demographic Correlates of Meeting the Physical Activity Recommendation Among Japanese Adults**.** *Journal of Physical Activity & Health*, *6*(1), 24-32.

Shin, Y.H. & Jang, H.J. (2000). Perceived exercise self-efficacy and exercise benefits/barriers of Korean adults with chronic diseases. *Journal of Korean Academy of Nursing,* 30, 869–879.

Sisson, S.B., Sarah M., Camhi, S.M., Tudor-Locke, C., Johnson, W.D., & Katzmarzyk, P.T. (2012). Characteristics of step-defined physical activity categories in U.S. adults. *American Journal of Health Promotion, 26*(3), 152-159.

Spanier P.A. & Allison, K.R. (2001). General social support and physical activity: an analysis of the Ontario Health Survey. *Canadian Journal of Public Health,* 92, 210–213.

Sternfeld, B., Ainsworth, B.E., & Quesenberry, C.P. (1999). Physical activity in a diverse population of women. *Preventive Medicine*, 28, 313–323.

Thompson, L.D., Rakow, J., & Perdue, M.S. (2004). Relationship between accumulated walking and body composition in middle-aged women. *Medicine & Science in Sports & Exercise*, 36, 911-914.

Trost S.G., Owen N., Bauman A.E., Sallis J.F., & Brown W. (2002). Correlates of adults' participation in physical activity: Review and update. *Medicine & Science in Sports & Exercise*, 34(12), 1996-2001.

Tucker, J.M., Gregory J. Welk, G.J., & Beyler, N.K. (2011). Physical activity in U.S. adults: Compliance with the Physical Activity Guidelines for Americans. *American Journal of Preventive Medicine*, 40(4), 454–461.

Tudor-Locke, C., Ainsworth, E.B., Thompson, W.R., Addy, L.C., & Jones, A.D. (2001). The relationship between pedometer-determined ambulatory activity and body composition variables. *International Journal of Obesity*, 25, 1571-1578.

Uchino, B.N. (2006). Social support and health: a review of physiological processes potentially underlying links to disease outcomes. *Journal of Behavioral Medicine*, 29, 377-387.

USDHHS. (2008). *Physical Activity Guidelines Advisory Committee report, 2008*. Washington DC: Author.

Yang, Y.J., Yoon, Y.S., Oh, S.W., & Lee ,E.S. (2005). The amount of physical activity of Korean adults measured from the 2001 Korean National Health and Nutrition Survey. *Journal of the Korean Academy of Family Medicine*, 26, 22–30.

Wankel, L.M. & Mummery, K. (1993). Using national survey data incorporating the theory of planned behavior: Implications for social marketing strategies in physical activity. *Journal of Applied Sport Psychology*, 5, 158–177.

Wankel, L.M., Mummery, W.K., Stephens, T., & Craig, C.L. (1994). Prediction of physical activity intention from social psychological variables: Results from the Campbell's Survey of Well-Being. *Journal of Sport and Exercise Psychology*, 16, 56–69.

Welk, C., Differding, J., Thompson, R., Blair, S., Dziura, J., & Hart, P. (2000). The utility of the Digi-Walker step counter to assess daily physical activity patterns. *Medicine & Science in Sports & Exercise*, 32, (9), 481-488.

Welk, G.J. (2001). *Physical Activity Assessments for Health-Related Research*. Human Kinetics.

Wendel-Vos, W., Droomers, M., Kremers S., Brug, J., & van Lenthe, F. (2007). Potential environmental determinants of physical activity in adults: a systematic review. *Obesity Reviews, 8*, 425-440.

Wilcox, S., Castro, C., King, A.C., Housemann, R., & Brownson, R.C. (2000). Determinants of leisure time physical activity in rural compared with urban older ethically diverse women in the United States. *Journal of Epidemiology & Community Health*, 54(9), 667-72.

Zhu, W., Timm, G., & Ainsworth, B. (2001). Rasch calibration and optimal categorization of an instrument measuring women's exercise perseverance and barriers. *Research Quarterly for Exercise & Sport,* 72, 104–116.

VITA

Rulan Shangguan was born in Jiangxi, China. After completing her work at China Agricultural University, Beijing, China in 2008, she received her degree of Bachelor of Science in Life Science. She entered Oklahoma State University, Stillwater, Oklahoma in 2008. During 2008 to 2010, she was employed as a graduate assistant. After receiving her degree of Master of Science in December 2010, She entered the Graduate School at the University of Texas at Austin.

Permanent Address: Jiangxi Agricultural University

Nanchang, Jiangxi, China 330045

This thesis was typed by the author.