

**STRUCTURAL RELATIONSHIP OF THE SOCIAL-
ECOLOGICAL AND PSYCHOLOGICAL CONSTRUCTS
ON THE AMOUNT OF PHYSICAL ACTIVITY AMONG
UNIVERSITY'S STUDENTS IN HEALTH CAMPUS,
UNIVERSITI SAINS MALAYSIA**

by

ABDULWALI SABO ABDULRAHMAN

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LIST OF ABBREVIATIONS TERMS

AVE	-	Average Variance Extracted
CFA	-	Confirmatory Factor Analysis
CFI	-	Comparative Fit Index
CI	-	Confidence Interval
CR	-	Composite Reliability
DB	-	Decisional Balance
DF	-	Degree of freedom
IPAQ	-	International Physical Activity Questionnaire
JEPeM	-	Jawatankuasa Etika Penyelidikan Manusia
KI	-	Kurtosis Index
MI	-	Modification Index
MLR	-	Maximum Likelihood estimation with Robust standard errors
MoE	-	Ministry of Education, Malaysia
MoH	-	Ministry of Health, Malaysia
PA	-	Physical Activity
PE	-	Physical Environment
PNSE	-	Psychological Needs Satisfaction in Exercise
RMR	-	Root Mean Square Residual

RMSEA	-	Root Mean Square Error of Approximation
SD	-	Standard deviation
SDT	-	Self-Determination Theory
SE	-	Social Environment
SEE	-	Self-Efficacy for Exercise
SEM	-	Structural Equation Modelling
SRMR	-	Standardised Root Mean Square Residual
TLI	-	Tucker Lewis Index
USM	-	Universiti Sains Malaysia
WHO	-	World Health Organisation

ABSTRAK

Pengenalan: Aktiviti fizikal dipengaruhi oleh rangkaian interaksi di antara faktor persekitaran sosial (contohnya, sokongan keluarga dan kawan-kawan), faktor persekitaran fizikal (contohnya, ketersediaan dan kualiti kemudahan senaman yang dirasakan), dan faktor psikologi (contohnya, kepuasan keperluan psikologi, keberkesanan diri, halangan dan manfaat yang dirasakan). Justeru, adanya keperluan untuk pemahaman saintifik terhadap hubungan antara pemboleh ubah tersebut dalam konteks tingkah laku aktiviti fizikal.

Objektif: Kajian ini bertujuan untuk menentukan kesahan ukuran skala dalam terjemahan Bahasa Melayu untuk menilai persekitaran sosial dan persekitaran fizikal. Seterusnya, memeriksa hubungan struktur dengan pemboleh ubah psikologi dan jumlah aktiviti fizikal antara pelajar sarjana muda dalam Kampus Kesihatan, Universiti Sains Malaysia (USM).

Kaedah: Kajian ini merupakan reka bentuk keratan rentas, menggunakan soal selidik laporan sendiri antara pelajar sarjana muda dalam Kampus Kesihatan, USM. Para peserta telah dipilih menggunakan kaedah bukan kebarangkalian, sebuah pendekatan pensampelan mudah. Persepsi berdasarkan persekitaran sosial, persekitaran fizikal, keseimbangan keputusan, keberkesanan diri untuk bersenam, kepuasan keperluan psikologi dalam senaman, dan jumlah aktiviti fizikal yang dinilai menggunakan skala versi terjemahan Bahasa Melayu. Analisis penghuraian, analisis pengesahan faktor (CFA) dan permodelan persamaan struktur (SEM) merupakan analisis yang digunakan.

Keputusan: Sejumlah 422 pelajar menyertai kajian ini. Purata umur peserta ialah 20.2 (SD = 1.27). Majoriti peserta ialah perempuan (69.7%) dan berbangsa Melayu (81.3%). Dalam penilaian model pengukuran, persekitaran sosial terjemahan Bahasa Melayu dengan 24 item mendedahkan data yang bagus dengan tiada item yang dipadam: CFI = 0.931, TLI = 0.923, SRMR = 0.058, RMSEA

(90%CI) = 0.060 (0.054, 0.066), RMSEA p-value = 0.002. CR ialah 0.942 dan 0.925, dan AVE ialah 0.593 dan 0.542. Skala persekitaran fizikal terjemahan Bahasa Melayu dengan lima item juga telah menunjukkan data yang bagus dengan tiada data yang dipadam: CFI = 0.989, TLI = 0.974, SRMR = 0.022, RMSEA (90%CI) = 0.054 (0.00, 0.102), RMSEA p-value = 0.373. CR ialah 0.743 dan 0.627, dan AVE ialah 0.465 dan 0.529. Tambahan lagi, model terakhir SEM telah menunjukkan data yang bagus: CFI = 0.968, SRMR = 0.036, RMSEA (90%CI) = 0.046 (0.025, 0.065), RMSEA p-value = 0.609 dengan disokong lapan hipotesis dan tiga laluan baru telah ditambah. Beberapa hubungan secara tidak langsung telah diperhatikan melibatkan laluan daripada sokongan kawan-kawan, ketersediaan kemudahan senaman, halangan dan manfaat senaman, keberkesanan diri terhadap aktiviti fizikal.

Kesimpulan: Model struktur hipotesis telah diuji dalam kajian ini, telah memberikan sebahagian bukti saintifik secara hubungan langsung dan tidak langsung antara pemboleh ubah persekitaran sosial, dan persekitaran fizikal dengan pemboleh ubah psikologi (keberkesanan diri, keseimbangan keputusan, dan kepuasan keperluan psikologi) dan jumlah aktiviti fizikal yang dilaporkan. Penemuan mampu berfungsi sebagai secebis maklumat berharga yang dapat membantu para pengkaji, pembuat polisi kesihatan, dan pendidik kesihatan dalam memahami dan mempromosikan tingkah laku aktiviti fizikal antara pelajar universiti.

ABSTRACT

Introduction: Physical activity is affected by a network of interactions between social environmental factors (e.g., family and friends support), physical environmental factors (e.g., perceived availability and quality of exercise facilities), and psychological factors (e.g., psychological need satisfaction, self-efficacy, perceived benefits and barriers). Therefore, there is a need for scientific understanding of the inter-relationship between these variables in the context of physical activity behaviour.

Objective: This study aimed to determine the measurement validity of the Malay translated version scales of social environment and physical environment. Subsequently, examine their structural relationship with psychological variables and amount of physical activity among undergraduate students in Health Campus, Universiti Sains Malaysia (USM).

Method: The study was a cross-sectional design in nature, using a self-reported questionnaire among undergraduate students in Health Campus, USM. Participants were selected using the non-probability method, a convenience sampling approach. Perceptions regarding social environment, physical environment, decisional balance, self-efficacy for exercise, psychological needs satisfaction in exercise, and amount of physical activity were assessed using Malay translated version scales. Descriptive statistics, confirmatory factor analysis (CFA), and structural equation modelling (SEM) were the employed statistical analyses.

Results: A total of 422 students participated in this study. The mean age of the participants was 20.2 years (SD =1.27). The majority of the participants were female (69.7%) and Malay (81.3%). In the measurement model validity, the Malay version of social environment with 24 items revealed a good fit to the data with no item deleted: CFI = 0.931, TLI = 0.923, SRMR = 0.058, RMSEA (90% CI) = 0.060 (0.054, 0.066), RMSEA p-value = 0.002. The CR was 0.942 and 0.925,

and the AVE was 0.593 and 0.542. The Malay translated version of the physical environment scale with five items also showed a good fit to the data with no item deleted: CFI = 0.989, TLI = 0.974, SRMR = 0.022, RMSEA = (90%CI) = 0.054 (0.00, 0.102), RMSEA p-value = 0.373. The CR was 0.743 and 0.627, and the AVE was 0.465 and 0.627. In addition, the SEM final model showed a good fit to the data: CFI = 0.968, SRMR = 0.036, RMSEA (90%CI) = 0.046 (0.025, 0.065), RMSEA p-value = 0.609 with eight hypotheses supported and three new pathways were added. Several indirect relationships were observed involving pathways from friends support, availability of exercise facilities, barriers and benefit of exercise, self-efficacy to physical activity.

Conclusion: The final results provide psychometric evidence for using social environment and physical environment scales to evaluate perceived environmental factors that are associated with physical activity participation among university students in Malaysia. All items were retained and confirmed to be fit for the sample data. The hypothesised structural model tested in this study, supported some scientific evidence of direct and indirect relationships between social environmental and physical environmental variables with psychological variables (self-efficacy, decisional balance, and psychological needs satisfaction) and amount of reported physical activity. The findings can serve as a piece of valuable information that could help researchers, health policymakers, and health educators in understanding and promoting physical activity behaviours among university students.

CHAPTER 1: INTRODUCTION

1.1 Background

The primary, dynamic approaches that can be adopted to lower the risk of various chronic diseases (e.g., cardiovascular diseases, non-insulin-dependent diabetes mellitus, osteoporosis, obesity, and some cancers) can be achieved through regular participation in physical activity (Pirasteh *et al.*, 2008). Regular exercise is a vital component of an effective, health-promoting lifestyle. For example, a 15-year prospective study confirmed that recreational physical activity is an independent predictor of a reduced cardiovascular mortality rate among adults (Dhaliwal *et al.*, 2013). After adjusting for both the Framingham Risk Score and central obesity (Waist circumference to Hip circumference Ratio), those in the high recreational physical activity group were 35% less likely than the low recreational physical activity group to have cardiovascular mortality outcomes (Dhaliwal *et al.*, 2013).

World Health Organization (WHO) has urged all member nations to promote policies and programs such as predicting behavior sustenance that improves health through diet and physical activity. However, each year, about 3 million deaths and 32 million disability-adjusted life years are associated with physical inactivity (WHO, 2008). In addition, habits of physical activity embraced during the early stages of life is expected to progress into adulthood, subsequently preventing the occurrence of chronic diseases that are associated with sedentary lifestyle in advanced age (Pirasteh *et al.*, 2008).

The functions of physical activity involves several domains (e.g. occupational physical activity, transport physical activity, and physical activity during leisure time) and several components (e.g. intensity, frequency, duration, and type) for purpose of health benefits

(Armstrong and Bull, 2006). These domains are generally recognized as the social, environmental, and psychological domains (Lee and Kim, 2017). Considering the intricate nature of the impacts of these variables on physical activity, a sound, and comprehensive framework is required to adequately describe these domains (Martinez *et al.*, 2012).

The social-ecological model, developed by Bronfenbrenner (1997), was used by numerous researchers in describing the relationship of physical activity with social environmental, physical environmental, and psychological factors (Sallis *et al.*, 2008). Precisely, they have employed this model to propose that physical activity is affected by a network of interactions between social environmental factors (e.g., family and friends support, social network, and social norm), and physical environmental factors (e.g., perceived availability and quality of exercise facilities), and psychological factors (e.g., psychological need satisfaction, self-efficacy, perceived benefits and barriers) (Lee and Kim, 2017).

Virtually all studies that examined the association between physical activity and social support have discovered a strong positive association. This association has been examined both in cross-sectional and prospective studies (DiLorenzo *et al.*, 1998; Sallis *et al.*, 1992; Sallis and Owen, 1998). Physical activity participation has been repeatedly found to be affected by family and friend support amongst a wide range of population groups (Sallis and Owen, 1998; Steptoe *et al.*, 1997; Sternfeld *et al.*, 1999). However, the absence of social support from family and friends is associated with a decreased level of physical activity participation (Ståhl *et al.*, 2001).

Environmental interventions are usually termed as "passive" interventions, because they are developed in a way that does not expect people to take any effort on an individual basis or to make effective behavioral changes (e.g. safe walking and bike paths, and injury

protection design). Activities that lead to developments in the environment are commonly executed at a societal level to decrease susceptibility to health risks, or to foster healthy behavior. Usually, environmental interventions possess a higher influence on all people irrespective of gender, level of income, and socio-economic status. Therefore, environmental interventions are regarded to be an essential component of public health action, corresponding to more individual methods of intervention such as health education (Ståhl *et al.*, 2001).

Decisional balance includes the perceived “pros” (benefits) and “cons” (barriers) of maintaining a particular behavior or adopting a behavior change. Decisional balance differs over the stages of change where it is hypothesized that decisional balance (pros minus cons) progresses from pre-contemplation to maintenance (Prochaska and Velicer, 1997; Prochaska *et al.*, 1994).

Self-efficacy is the individual confidence and ability to plan and succeed the course of action needed for a given fulfilment and to oppose the bait to relapse. It is essential because the people that have greater self-efficacy when performing activity managed to strive more and encounter extra positive emotions relating to the task (Bandura, 1997). It is an important construct in the social cognitive theory which has been employed by researchers in describing factors that influences exercise behaviours (Bandura, 1997).

Psychological need satisfaction serves as an inherent requirement for nourishing growth, integrity, and well-being. Consequently, the strategy exerted by self-determination theory (SDT) is that the impacts of obtaining basic psychological needs are considered universal, as such environments that provide these atmospheres will enhance well-being, whereas settings that lack need satisfaction will hinder the development of motivation and lead to

lower well-being (Deci and Ryan, 2002). The ‘Physical Activity Assessment Questionnaire’ is a standardised scale that is vital and essential part of public health surveillance for the assessment of current issues regarding level of physical activity. Physical activity surveillance in the general population is frequently measured applying a self-reported measures, because they are more or less costly and comparatively less tedious to apply than the more objective assessment tools (Armstrong and Bull, 2006).

According to social-ecological model, the amount of physical activity participation is influenced by the inter-relationships of the social environmental factors (social environment and physical environment) with psychological factors (psychological need satisfaction, self-efficacy, decisional balance) (Sniehotta *et al.*, 2013). Many research linked with physical activity studies and social-ecological model showed that the physical environment, social environment and psychological variables are directly related to physical activity participation (Brownson *et al.*, 2009; Carlson *et al.*, 2012). Therefore, considering the social-ecological model establishes a direct connection between social environment and physical activity behaviour, it is likewise imperative to understand the role of psychological variables as mediators in the relationship between the social environmental factors and physical activity.

Generally, Latent variables in structural equation modelling analysis refer to hypothetical constructs or factors, which are explanatory variables considered to reflect a continuum that cannot be measured directly Kline (2011). An example is the construct of intelligence. There are numerous ways to measure intelligence. Hence, researchers employed various types of observed variables, such as tasks of verbal reasoning or memory capacity, to evaluate different aspects of intelligence Kline (2011). Latent variables represent a wide

range of phenomena. For example, constructs of social-ecological in the present study includes: family support, friends support, availability of exercise facilities, and quality of exercise facilities.

1.2 Problem Statements

It is an established fact that routine participation in physical activity among adolescents leads to various health benefits. Societies that have a lower level of physical activity are associated with many health-related issues (Hallal *et al.*, 2012). However, even with widespread knowledge concerning health information about the benefits of frequent physical activity participation, there is still a high prevalence of physical inactivity in industrialized countries (Martinez *et al.*, 2013).

Physical inactivity is reported as the fourth risk factor of mortality in the world that leads to 6% mortality rate annually (WHO, 2008). Despite all the evidence supporting positive health and mental benefits of regular participation in physical activity, several studies have indicated that a large number of adults worldwide do not participate in regular recommended levels of physical activity to achieve optimum health state. About 36% of Malaysian adults do not practice a physically active lifestyle, and based on the Malaysian Adults Nutrition Survey only 11-15% of them were physically active (Cheah and Poh, 2014).

Factors associated with physical inactivity are lack of awareness and understanding of the importance of regular physical activity. Collective attempts have been employed by researchers in understanding and promoting the complex behavioral and cognitive approaches that might be beneficial for enhancing and maintaining physical activity based on the social-ecological model. However, the studies of the effect of inter-relationship

between social-ecological and psychological constructs on physical activity are still lacking.

1.3 Significance of the study

Acknowledging the importance of physical activity in the prevention of chronic diseases, it is essential to acquire relevant data using a standardised measure of physical activity that will apprise within country public health efforts and for inter-country assessment. However, given that physical activity is influenced by the interaction between the social-environmental variables (family support and friends support), and physical environmental variables (availability and quality) with psychological variables (self-efficacy, decisional balance, and psychological needs satisfaction), it is imperative to obtain related data using a standardised measure of these variables.

Physical activity is one of the important health behaviors that are affected by various factors, therefore it is not enough to explain physical activity from a single psychological model (e.g., self-efficacy theory, planned behavior theory, etc.).

In order to better understand physical activity, it is necessary to apply a comprehensive viewpoint model which includes various variables (social, environmental, and psychological variables).

1.4 Rationale of the study

In general, many researchers have illustrated how these social-ecological and psychological variables have a direct significant association with physical activity (Brownson *et al.*, 2009; Carlson *et al.*, 2012). However, despite these direct connections, it is imperative to determine the probable mediating role these psychological variables in

the links between environmental factors and physical activity. For instance, various empirical studies have proved a direct association of physical activity with social and physical environmental factors, but the strength of these relationships is intensified when psychological variables (i.e., psychological needs satisfaction, self-efficacy, perceived benefits, and perceived barriers) are added in the model (Lee and Kim, 2017).

The social-ecological model includes various psychological, social and environmental variables that affect physical activity from a comprehensive viewpoint. The social-ecological model has lately drawn increasing attention as an effective conceptual framework to explain physical activity in exercise psychology. Therefore, this study can serve as a model to the Malaysian Ministry of Health (MoH) and Ministry of education (MoE), for understanding and implementing effective programs and policies to promote and educate university students to practice and maintain a healthy lifestyle.

In conclusion, since health-promotion interventions attempts to promote physical activity, hence, testing the validity and reliability of the instruments used in measuring variables that influences level of physical activity is essential and can be used to assess the effectiveness of such health programs objectively.

1.5 Operational Definition

Structural equation modelling (SEM)	-	Is a method of analysis by using an affirmative (i.e., testing hypothesis) procedure when analysing a structural theory supporting some aspects. Generally, this aspect of theory describes causal means that create observations on numerous variables (Byrne, 2013).
Amount of physical activity (IPAQ)		Three levels(categories) of physical activity are proposed: 1- Low: individuals who do not meet criteria for category 2 or 3.

		<p>2- Moderate: 3 or more days of vigorous activity of at least 20 minute/day or 5 or more days of moderate-intensity activity or walking of at least 30 minutes.</p> <p>3. High: Vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week (Craig <i>et al.</i>, 2003)</p>
Social environment	-	Can be defined as the perception that one has assistance, and support to engage in exercise activities from family and friends, or the degree to which a person is integrated in a social network (Ståhl <i>et al.</i> , 2001).
Physical environment	-	Refers to the availability of and accessibility to exercise facilities, perceived qualities and safety of facilities (Manteiga <i>et al.</i> , 2017)
Self-efficacy		Self-efficacy is a person's belief in capabilities to overcome personal, social and environment barriers to exercise. As such, self-efficacy is essential because a person with a higher level of self-efficacy when performing any activity will strive more in that activity and also encounter extra strong-minded feelings associated with the activities (Bandura, 1997).
Perceived benefits and barriers		Individuals' Perception of benefits of exercise and barriers related to exercise are a general collection of items reflecting the perception of positive viewpoints and negative viewpoint that denote aspects of behavioral variation (Bernard <i>et al.</i> , 2014).
Psychological need satisfaction in exercise (PNSE)		The psychological needs comprises autonomy, relatedness, and competence and have been defined to be inherent and vital for nourishing essential growth (Ryan, 1995).

1.6 Chapter summary

This chapter, presented a summary of the study. Commencing with the introduction of this research, accompanied by some illustrations regarding the statement of problems and the significance of the research. Also, the rationale of this research and operational definitions have been illustrated.

CHAPTER 2: RESEARCH QUESTIONS, HYPOTHESES AND OBJECTIVES

2.1 Research questions

1. Are the factor structures of Malay translated version of social environment scale and physical environment scale valid and reliable among undergraduate students in Universiti Sains Malaysia (USM), by using confirmatory factor analysis (CFA)?
2. Are there any significant path relationships between social-ecological (social environment and physical environment), with psychological variables (i.e., psychological need satisfaction, self- efficacy, perceived benefits, and perceived barriers) and total amount of reported physical activity among undergraduate students in USM?

2.2 Research objectives

2.2.1 General objective

To determine the structural relationship between components of social-ecological (physical environment and social environment) with psychological components (self-efficacy, perceived benefits, perceived barriers and psychological need satisfaction) and total amount of reported physical activity among undergraduate students in USM.

2.2.2 Specific objectives

1. To confirm the validity and reliability of the factor structure of the Malay translated version of social environment scale and physical environment scale among undergraduate students in Health Campus, USM, using CFA and composite reliability (CR).

2. To examine the path relationships between social-ecological (i.e., social environment and physical environment) with psychological variables (i.e., self-efficacy, perceived benefits, perceived barriers and psychological need satisfaction) and the total amount of reported physical activity among undergraduate students in Health Campus, USM, using SEM analysis.

2.3 Research hypotheses

1. The Malay translated version of social environment scale and physical environment scale are valid and reliable for use among undergraduate students in USM by using CFA.
2. There are significant path relationships between social-ecological (i.e., social environment and physical environment), psychological variables (i.e., psychological need satisfaction, self-efficacy, and perceived benefit and perceived barriers) and total amount of reported physical activity among undergraduate students in USM.

CHAPTER 3: LITERATURE REVIEW

3.1 Introduction of the chapter

This chapter acts as an overview of the previous literatures by developing a full depiction regarding the current understanding and knowledge pertaining to the issues related to this study in order to facilitate the researchers appreciate the previous studies that were recognized by scholars and researchers. It also identified gaps or discrepancies between existing knowledge, thus aiding to persuade research views (Cronin *et al.*, 2008).

The literature review in this study was assembled into ninth sections including issues that agree or disagree with the study hypotheses. The initial part (section 3.2) covers about exploration words and utilised databases, secondly (3.3) about social environment, third (3.4) about physical environment, fourth (3.5) about self-efficacy for exercise (3.6), fifth (3.7) about psychological need satisfaction in exercise, seventh (3.8) about International Physical Activity Questionnaire (IPAQ), lastly (3.9) covers past literature review. The final section (3.10) focuses on the study's conceptual framework regarding the interrelationship between the social-ecological model and psychological variables with a total amount of reported physical activity.

3.2 Search terms and databases

An extensive exploration of the electronic databases was conducted which includes: PubMed, Scopus, ScienceDirect, Google Scholar, ProQuest, Sage Journal and for relevant journals, theses, books, and articles. The relevant search phrases used independently or in succession included social environmental support for exercise, physical environment support for exercise, self-efficacy for exercise, psychological needs satisfaction in exercise, perceived benefits and barriers, and International physical activity.

3.3 Social Environment (SE)

There have been numerous suggestions regarding the definition and description of social environment (SE). Some examine it as a special aspect of support such as trades of knowledge or material aid, some consider it as having a friend, and some consider it to be a satisfaction of fundamental social needs (Wallston *et al.*, 1983). In a broad sense, SE support represents the level of assistance, comfort, and information a person gets through the means of formal or informal relationships beside individuals or groups. This description traverses a series of events such as a neighborhood adolescent assisting an elderly person in carrying groceries, agitated friend receiving compassionate attention from a companion, and a social group rendering some counseling programs whereby a separated or divorced couples can make fresh acquaintances. To the degree that a diverse group of events can be conceived as possessing a shared psychosocial impact, that SE symbolizes a unitary construct, the extent to which these related events signify various and probably distinct aspects, the expression SE support illustrates some shared elements with multiple constellations of constructs. Apparently, the latter is the case, an affirmation held by the divergence of conceptual views and measurement methods employed in SE support (Donald *et al.*, 1978).

Earlier studies have conceptualized SE support along two primary dimensions (Wallston *et al.*, 1983). The first dimension was quantitative versus qualitative. SE support was expressed as "amount" such as the number of people an individual associated with, the number of times one has contact with selective others, and the number of contact amidst those others; or (b) expressed as "goodness" measures, such as level of perceived interpersonal contacts. Some researchers favor one or the other opinion, yet others affirm

that quality and level of social contact are evenly important (Donald *et al.*, 1978). The second dimension distinguishes between instrumental and expressive support. The instrumental involves rendering material aid and knowledge, whereas expressive support involves being someone's confidant and offering them acceptance and understanding. However this dimension are often considered simultaneously (Lin *et al.*, 1981).

Numerous notions and classifications have been utilized to explain SE support and its constructs (Lakey and Orehek, 2011; Sarason and Sarason, 2009; Wills and Shinar, 2000). Despite SE support having complex and multiple dimensions, it represents the aid and assistance shared through social contacts and interpersonal activities (Scarapicchia *et al.*, 2017). SE support signifies the concept for the availability of supportive actions or perceptions when demanded. This illustrates the relative distinction between the SE support an individual gets and an individual's perception of such support. While numerous studies fail to establish a precise distinction between perceived SE supports and received SE support, perceived SE support is more reportedly associated with positive health outcomes (Uchino, 2009; Wills and Shinar, 2000).

In general, there are various identified types and sources of SE support such as instrumental (e.g., offering substantial financial or material support); appraisal (e.g., providing companionship, social identification); informational (e.g., offering guidance and resources); and emotional (e.g., showing empathy, care, and motivation) support (Scarapicchia *et al.*, 2017; Tay *et al.*, 2013). The multiple sources of SE support have been principally recognized to involve family, friends/peers, and notable others (Heaney and Israel, 2008; Scarapicchia *et al.*, 2017; Tay *et al.*, 2013). With a connection linking these sources as operationalized SE support networks (Scarapicchia *et al.*, 2017, 2003). The

kind of these SE support networks may affect the quantity and quality of accessible SE support. SE support networks can fluctuate based on features, for example, the extent of the network, consistency, intensity, and uniformity of these social connections (Cauce *et al.*, 1994; Scarapicchia *et al.*, 2017).

3.4 Physical Environment (PE)

According to Sallis *et al.* (1998), the physical environment is regarded as the degree of available compensations or limitations that determine health practice suitable or less suitable. Incentive environments are regarded as those that present the best available exercise facilities such as sports fields, bicycle paths and swimming pools. Restricting environments are those which restrain access, or encourage engaging sedentary environments, for instance, busy highway systems and idle games places. Laws and strategies that provide possibilities or constraints for physically active behaviour are strongly associated with the physical environment (Sallis *et al.*, 1998). In general, a physical and policy environment that are supporting portrays both the physical/organisational environment and the policies which establish this environment.

Aspects of the physical environment are assessed by objective and perceived measures (Jáuregui *et al.*, 2016; Leslie *et al.*, 2007). Perceived measures represent vital and distinct dimensions that influence physical activity participation, and allow for evaluating important aspects of the physical environment that are hard to assess objectively such as safety of environment and aesthetics (Arvidsson *et al.*, 2012). Acknowledging the fact that objective measures are not regularly corresponding with perceived measures, in some situations offering programs that increase awareness, preferably than reconstructing the physical environment, may be a more efficient approach to increasing medium to vigorous

physical activity, particularly if delivered to population groups with low perceived physical environment scores yet residing in objectively acquired activity-favorable environments (Gebel *et al.*, 2011).

3.5 Decisional balance (perceived benefits and barriers)

Decisional balance signifies the perceived benefits (pros) and perceived barriers (cons) related to exercise behavior that is essential process in making decision (Janis and Mann, 1977). Perceived benefits for exercise involve enhanced self-confidence, physical strength, and aerobic ability. Perceived barriers to exercise involve physical distress, cost, and consuming time by not doing some activities. Many researchers reported that the level of perceived benefits increases while the barriers decrease within the stages of behavior change (Prochaska and Marcus, 1994). The decision balance construct reflects the struggle model of making decision and associates with the person balancing between perceived benefits and perceived barriers (i.e. pros and cons) of distinct health practice.

3.6 Self-Efficacy for Exercise (SEE)

Self-efficacy is an important domain within numerous theories that are common within the field of health psychology like the Transtheoretical model (Prochaska and DiClemente, 1982), social cognitive theory (Bandura, 1997), protection motivation theory (Rogers, 1975), health action process approach (Schwarzer, 1999), perceived behavioral control theory, and planned behavior theory (Ajzen, 1991).

Despite the importance of self-efficacy in determining many behaviors, there is yet not enough information about how to modify this psychological factor, making the issue an important gap of knowledge because many researchers are attempting to produce interventions with no proof of which method of intervention is efficient and which is

inefficient (Ashford *et al.*, 2010). The information regarding the proposed sources of self-efficacy was already established (Bandura, 1997). However, it is still essential to interpret how they can be appropriately operationalised when designing interventions for behavior change. It has been suggested that self-efficacy for a particular distinct behavior is related to four categories of information: that is verbal persuasion, experience from enactive mastery, physiological or affective states and vicarious (acting) experience. Enactive mastery experience indicates the successful execution of the intended behavior, which can increase the perception for one's self-efficacy, whereas the inability to execute the behavior decrease one's self-efficacy. Vicarious experience represents seeing a 'related other' successfully execute the behavior and evaluating one's individual achievement toward the fulfillment of that related other. Verbal persuasion, whereby others display confidence in the individual's abilities explains the information regarding the third source of self-efficacy (Bandura, 1977), although it has consistently been debated that the consequences of this technique are not likely to be enduring (Bandura, 1997). Overcoming negative emotional situations and modifying misinterpretations of physical states is the fourth way that improves self-efficacy perceptions (Bandura, 1977).

3.7 Psychological Need Satisfaction in Exercise

According to Deci and Ryan (1985, 2002), psychological needs for autonomy, competence, and relatedness is considered to be the extent for which social settings meet the essential requirements that will sustain growth and improve well-being. The competence models represents feeling productive and able to adhering challenging responsibilities in one's environment (White, 1959). Autonomy originates from a study on the internal perceived locus of causality and illustrates feeling agentic and freely in

one's behavioural attempts, as an object to a pledge to external factors or schedules (De Charms, 2013). Lastly, the concept of relatedness expresses feeling meaningfully attached to others or a heightened feeling of belonging to one's community in general (Baumeister and Leary, 1995).

According to SDT, these basic psychological needs is integral to fostering the internalization of cultural standards and values into a comprehensible self-structure (Deci and Ryan, 2002; Deci and Ryan, 1985). SDT's interpretation of needs views these psychological forces to be inherent and universal in their positive effect on well-being (Deci and Ryan, 2002). The concept of well-being, from an SDT viewpoint (Deci and Ryan, 2002), is not regarded completely with hedonic beliefs that limit their focus to the pursuance of pleasure/happiness or the inhibition of pain (Deci *et al.*, 2001). Nonetheless, SDT centers on eudaimonic well-being, which involved the functionality of organism and self-actualization that prospers when social settings promote the satisfaction of basic psychological needs (Deci *et al.*, 2001).

3.8 International Physical Activity Questionnaire (IPAQ)

There are numerous ways to examine physical activity data, however, there is no established consensus on a 'conventional' approach for determining or characterizing levels of physical activity based on self-report population surveys. The application of various scoring guideline leads to difficulties in distinguishing within and between countries, even when a similar instrument has been employed. Application of these scoring techniques will improve the comparison between studies if similar sampling and study designs have been employed (IPAQ, 2005).

3.8.1 Uses IPAQ Instruments according to International research committee on IPAQ (IPAQ, 2005)

IPAQ short form is a tool devised essentially for assessing physical activity in a general population. It was constructed and deemed to be applied among adults (15-69 years) and until additional construction and examination are offered in the application of IPAQ amidst adult and adolescent groups is not suggested.

IPAQ short and long forms are seldom being utilized as an evaluation instrument for interventional studies, nonetheless, this wasn't the proposed design of IPAQ. All researchers must thoroughly regard the spectrum of domains with classes of activities involved in IPAQ before applying it in these circumstances. Application to assess outcome measures in experimental studies with smaller sample size is discouraged.

3.8.2 Summary Characteristics of IPAQ Short Form (IPAQ, 2005)

IPAQ evaluates engaged physical activity across a broad set of constructs including:

- a. Physical activity related to domestic and home activities
- b. Physical activity for leisure time
- c. Physical activity related to transport
- d. Physical activity related to work

The short form of IPAQ scale regarding three distinct types of activity engaged in the four domains presented above. The distinct sorts of activities been evaluated are vigorous-intensity activities, moderate and walking.

The questions included in the IPAQ short form were design to render different scores representing walking, moderate, and vigorous activities. Estimation for the cumulative

score involves the addition of the total duration (minutes) and the days (frequency) of walking, moderate and vigorous activities. Specific measures for separate domain are not computed.

Data obtained with IPAQ should be presented as a numerical scale. Each assessment of the total of activity score can be calculated by averaging specific exercise type with its corresponding energy demands specified in METs to generate a value in MET–minutes. The multiples of the resting metabolic rate and a MET-minute is estimated by multiplying the MET score of an exercise by the minutes done. MET-minute scores are equal to kilocalories for a 60kilogram person. Kilocalories may be calculated from MET-minutes by employing an equation: MET-min x (weight in kg/60kg). MET-minutes/day or MET-minutes/week can be performed, nonetheless, the latter is more generally employed and is thus recommended (IPAQ, 2005).

3.8.3 MET Values and Formula for Computation of MET-minutes/week (IPAQ, 2005)

The resulting scores are obtained from the computation of IPAQ data: Walking = 3.3 METs, Moderate PA = 4.0 METs and Vigorous PA = 8.0 METs. Using these values, four continuous scores are described:

Walking MET-minutes/week = 3.3 x walking minutes x walking days.

Moderate MET-minutes/week = 4.0 x moderate-intensity activity minutes x moderate days.

Vigorous MET-minutes/week = 8.0 x vigorous-intensity activity minutes x vigorous-intensity days.

Total physical activity MET-minutes/week = sum of Walking + Moderate + Vigorous MET-minutes/week scores.

3.8.4 Rules of IPAQ computation (IPAQ, 2005)

All cases with a sum total of all Walking, Moderate and Vigorous time variables higher than 960 minutes (16 hours) should be omitted from the analysis. This implies that on average an individual spent 8 hours per day sleeping. The 'days' variables can take the range 0-7 days, or 8, 9 (don't know or refused); values higher than 9 should also be omitted and those cases excluded from final analysis.

Only values of 10 or greater minutes of activity should be involved in the computation of total scores. The basis being that the scientific evidence designates that episodes or sessions of at least 10 minutes are needed to obtain health benefits. Answers of less than 10 minutes should be excluded from the analysis.

In IPAQ short - it is suggested that all Walking, Moderate and Vigorous time variables exceeding '3 hours' or '180 minutes' are truncated (that is re-coded) to be equal to '180 minutes' in a fresh variable. This rule allows a maximum of 21 hours of activity in a week to be reported for a specific category (3 hours * 7 days). This rule endeavors to normalize the distribution of levels of activity which are typically skewed in national or wide population datasets.

3.9 Relationships among the study variables (social-ecological, psychological, and PA)

The hypothesised model was based on the study of Lee and Kim (2017), which investigated the relationships of social-environmental, physical environmental, with

psychological variables and amount of physical activity and examined the mediating role of psychological variables in the relationship between the environmental variables and physical activity among a random sample of Korean middle-aged adults. The modified hypothesised model in this study has added the PNSE in the structural model. According to the fit indices from Lee and Kim (2017), the proposed model had an excellent fit to the data ($X^2 = 212.098$, $DF = 352$, $p\text{-value} = .001$, Goodness of fit Index = .923, CFI = .942, and RMSEA = .067).

3.9.1 Relationship between SE and Physical Activity

Social support and social network have a significant influence on health behaviors such as diet and physical activity participation (Tamers *et al.*, 2011). For instance, higher perceived social support from the workplace was related to an increased amount of physical activity and with more fruit and vegetable intake (Tamers *et al.*, 2011). Furthermore, various cross-sectional studies have illustrated that there is increased participation in physical activity with a higher level of social support, especially among women (Bauman *et al.*, 2012; Choi *et al.*, 2017; Hallal *et al.*, 2012). For instance, social support from family and parents in high-income families was shown to have a significant influence on physical activity participation (Bauman *et al.*, 2012).

3.9.2 Relationship between SE and Psychological variables

Several theories and models related to social relationships and coping have been employed to illustrate the connection between SE support and health (Scarapicchia *et al.*, 2017). According to these conceptual frameworks, SE support can, directly and indirectly, affect physical and psychological health by encouraging someone to acquire healthy behaviors, such as physical activity participation. Direct effects involve rendering material support

such as financial assistance to be physically active, while the indirect effect may be mediated by other variables such as self-efficacy (Gottlieb *et al.*, 2000). Increase social support can also decrease the possibility of individuals acquiring harmful behaviors, by reducing the influence of periodic stressors or stressful circumstances (Heaney and Israel, 2008) or by performing healthy practices such as physical activity (Beets *et al.*, 2010).

The relationship between family support and physical activity was found to be significantly mediated by self-efficacy and perceived benefits (Lee and Kim, 2017), This is also consistent with other study findings that social support influences physical activity through self-efficacy and motivation (Haughton McNeill *et al.*, 2006; Motl *et al.*, 2006; Rovniak *et al.*, 2002). Social support exerted a moderate total influence on self-efficacy for exercise, implying that a supportive social network can promote consistent participation in physical activity and that routinely scheduled exercise activities with supportive friends can help maintain an active lifestyle (Rovniak *et al.*, 2002).

Previous research has shown that social support from parents for psychological needs was positively associated with children's autonomous motivation for schoolwork (Grolnick and Ryan, 1989), and teachers' support of these needs was associated with enhanced autonomous motivation in medical students (Williams and Deci, 1996). Additionally, one study investigated need satisfaction with various relational associates (i.e., parents, friends, roommate, etc.), relating need satisfaction in each relationship to attachment security in that relationship. All the participants in that study reported significantly increase levels of need satisfaction and attachment for all relationships (La Guardia *et al.*, 2000).

3.9.3 Relationship between Physical Environment and Physical Activity

Over the last 15 years, there has been an increasing concern about the importance of the built environment in promoting physical activity. Relative to other health promotion programs, the provision of adequate built environments that will promote physical activity is a sustainable plan for inspiring people to embrace, or and raise levels of physical activity (McCormack and Shiell, 2011). Individuals living environment is particularly important because it is where most of the physical activity, like walking, is undertaken (Giles-Corti *et al.*, 2008).

Presently there have been long distances between peoples' homes and places of destination, dropped population densities, and unconnected streets designs, all as a consequence of modern land development. All these are indicative of urban sprawl, which have an influence on a societal problems because it negatively affects physical activity level and health (Ewing, 2005; Frumkin, 2002; Frumkin *et al.*, 2004; Sturm and Cohen, 2004). Components like proximity to one's home, good connectivity of streets network, population density, available pedestrian structures, aesthetics, and safety are independently associated with physical activities such as walking and jogging (McCormack and Shiell, 2011). Accessibility of a mix of neighborhood recreational and non-recreational sites such as cafes, supermarkets, eateries, other retail, institutions, and place of worships is positively correlated with leisure walking (McCormack *et al.*, 2008; McCormack and Shiell, 2011). Areas that have numerous intersections (i.e., grid-like road design) provide easier and alternative paths to places supporting walking relative to areas that have fewer intersections (i.e., curvilinear-like road design) (Frank *et al.*, 2005).