Prevalence, Stages of Change for Lifestyle-Related Cardiovascular Risk Factors, and Influencing Factors of Physical Activity among Thai Young Adults

Sunthara Liangchawengwong, Linchong Pothiban, Sirirat Panuthai, Pikul Boonchuang

Abstract: This descriptive correlational design aimed to investigate the prevalence and stages of change of lifestyle-related cardiovascular risk factors, test associations and the ability to predict change transition of the Transtheoretical model constructs for physical activity among Thai young adults. Multistage proportion cluster sampling method was employed to obtain 1,124 first-to fourth-year students of eight government universities in Thailand. Data were collected by six instruments, and analyzed using descriptive statistics, Pearson χ^2 – test, MANOVA, and the multinomial logistic regression.

The results revealed that participants had a high prevalence of physical inactivity (81.49%), unhealthy dietary habits (58.62%), sedentary lifestyle (57.29%), alcohol consumption (41.01%), stressful lifestyle (26.78%), and cigarette smoking (9.34%). Most reported being inactive in most of all lifestyle-related cardiovascular risk factors. A similar distribution of the stages of change was apparent both genders, and the first-to fourth-year students. Stages of lifestyle-related cardiovascular risk factors change were correlated with stages of physical activity change ($p<0.001$). The Transtheoretical Model constructs; Self-efficacy, pros, cons, and processes of change were correlated with stages of change of physical activity. Only, cons was the highest affected of all the stages of physical activity change. These results suggest that young adults should be the prioritized group for working to prevent cardiovascular disease, especially by health-promoting nurses, and health professionals and educators.

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Background

Cardiovascular disease (CVD) is a major health worldwide[1] and lifestyles, including unhealthy dietary habits, physical inactivity, sedentary lifestyle, stress, cigarette smoking, and alcohol consumption are related etiology.[1-2] These lifestyles usually form during early young adulthood (age 18-24 years).[3-4] Many studies from the Western countries have revealed that young

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adults in college have a high prevalence of lifestyle-related cardiovascular risk factors (CVRF) and are at risk for early CVD. One study found that 35% of 1,088 college students had one risk, 11% had two, and 3% had three or more.[5] In Germany, cross-sectional data of 12,835 young adults aged 17-25 years found that there were high percentages of CVRF and it increased according to age and peaked at 25 years.[6]

A study by the American Heart Association reported that physical inactivity is associated with about a twofold increased risk of CVD and is connected with other lifestyle-related CVRF.[7] Another study found that college students that were physically inactive, showed a higher intake of dietary fat and cholesterol, had higher stress, smoked more, and consumed alcohol more than students that were physically active.[8] The Healthy Campus 2010 project identified physical inactivity as one of the six priority health risk behaviors that students establish in college, which have a long term impact on adult physical activity habits and are likely to be maintained for a long time.[9] Recent studies have also found that the utility of physical activity in enhancing other lifestyle-related CVRFs among young adults, such as smoking cessation,[12] decreased alcohol consumption,[13] and decreased depression.[14] Adopting physical activity also results in limited dietary fat, increased fruit and vegetable intake, and leads to dietary habit changes.[15] Therefore, physical inactivity should be a priority for lifestyle modification.

In Thailand, many studies have also found that young adults in university have exacerbated declines in physical activity levels. Research on sport and exercise promotion for good health in 76 provinces[16] found that 22.4-31.5% of college students exercised regularly. Moreover, a study in Chiang MaiUniversity[17] found that only 2.7% of students reported having appropriate exercise behaviors, 83% reported having inappropriate physical exercise, and 14.3% of them were not physically active. Additionally, a study of physical activity at Khon Kaen University found that 22.7% of students exercise regularly.[18] Therefore, the physical activity of Thai college students requires attention and should be modified.

As the findings above indicate, certain lifestyle-related CVRF occur in combination and tend to cluster within young adults[11]. From this perspective, many investigators have suggested that young adults' health risk behaviors share common determinants, intention, motivation, cognition, and behavioral strategies and they may use that knowledge to change behaviors simultaneously.[9-10] Traditionally, most theories of behavior change are based on the "all or none phenomenon" of behavior that is shown to be useful for explaining single behavior but does not sufficiently explain the gap in multiple behavior changes. On the other hand, the Transtheoretical Model (TTM)[19] emphasizes that the readiness of people to change was not based on all or none phenomenon. The TTM explains how, and predicts behavior change as demonstrated in the concepts of stages of change, self-efficacy, decisional balance, and processes of change. Many studies have found that lifestyle-related CVRF (i.e. smoking, dietary fat reduction, physically active) is a stage-by-stage progression and that there is a great need for examining the variables associated with the stages transition.

The TTM involves five stages of behavior change, including: pre-contemplation contemplation, preparation, action, and maintenance. The Theory also includes self-efficacy, which is an individual's confidence in overcoming risk behavior in various situations; decisional balance, which is the individual's weighing of benefits and barriers of engaging in a healthy lifestyle; and the processes of change comprised of five cognitive processes and five behavioral processes that individuals use to modify their lifestyles and progress through the stages of change.

As reviewed earlier, physical inactivity and other lifestyle-related CVRF have been shown to be highly prevalent among young adults worldwide. In Thailand, there is little data available regarding the prevalence of lifestyle-related CVRF among young adults. For this reason the prevalence of lifestyle-related CVRF among Thai young adults was investigated in this study. The TTM was initiated and has succeeded in promoting a new generation of innovative research to approach multiple behaviors. Therefore, this study aims to identify the prevalence and stages of change of lifestyle-related CVRF, explain the associations between stages of change in physical activity and other lifestyles, and investigate the ability of the TTM concepts in explaining variability of physical activity change among Thai young adults.

Theoretical Framework

This study used the Transtheoretical Model of Prochaska and DiClemente[20-21] as a framework that postulates that behavior change is not a static or binary phenomenon. Instead, behavior change is conceptualized as a temporal movement through a series of stages and each stage can be defined by intentions and behavior of interest. The four theoretical constructs were central to change, including stages of change (intention to take action), decisional balance (benefit and barrier of the behavior change), self-efficacy[23] (confidence to make and sustain changes in various situations), and processes of change (activities that facilitate change). The basic element of this model is that when people change a behavior, they move through a series of five sequential stages: *Pre-contemplation* is the stage of not considering to change behavior with in the next 6 months. *Contemplation* is the stage of considering to change new behaviors in the next 6 months but not deciding to change. *Preparation* is the stage of engaging in new behaviors change within 30 days. *Action* is the stage of readiness to initiate change but not more than six months. *Maintenance* is the stage of actual successful action usually continued for more than six months[19,21].

The processes of change describe the strategies that individuals may choose to modify their lifestyle. These factors comprise covert and overt activities which can be identified as cognitive and behavioral strategies. Individuals at different stages of behavior change should use a variety of processes of change, both cognitive and behavioral strategies.[22] Self-efficacy is employed as an intermediate outcome variable that enables the stages transitions,[23] while decisional balance identifies the weighing of pros and cons in engaging in a new lifestyle. In adopting a new behavior, the disadvantages of the behavior (cons) are high and the positive aspects of the behavior (pros) are low during the inactive stages. The crossover between pros and cons has been found during the progression to the active stages.

In brief, individuals change their lifestyles by moving in the stages. The stages transitions depend on the readiness of intention and the proportion of variables, including processes of change, decisional balance, and self-efficacy. These components of the TTM could provide a theoretical framework to guide and enhance lifestyle-related CVRF change.

Method

Design: A cross-sectional, descriptive correlational design was used.

Setting: Subjects were collected from the eight government universities located in five geographical regions and in Bangkok, the capital of Thailand.

Sample: The sample size of this study was calculated using the determination of Yamane.[24] A 95% confidence level and $p = 0.05$ were assumed for the equation. From the calculation, the sample size was 400. By adding a 50% attrition rate and the

present study used a multistage proportion cluster sampling to obtain samples as the criteria for 20 participants in every cluster cell. Therefore, the estimation of the samples was 1,280 university students.

Instruments: The data was gathered using six standardized self-reported questionnaires. All instruments were got permission from the original authors and modified by the researcher. Back translation before testing was done and the Cronbach Alpha coefficient was conducted in 34 university students were tested for their content validity and internal consistency

1. *Lifestyle-related CVRF Assessment Form, composed of six parts.*

Part 1: The Unhealthy Dietary Habits Assessment Form was modified from Block, Gillespie, Rosenbaum, and Jenson.[25] The scale was composed of 14 items for asking the participants about their frequency of unhealthy dietary habits during the past 3 months. 5-point Likert scale ranged from never (score 0) to very often (score 4),and score of 42-56 was identified as high risk. The test of scale content validity index (S-CVI) was1.00, the Cronbach Alpha coefficient was 0.79, and the test-retest reliability was 0.80.

Part 2: The Physical Inactivity Assessment Form was modified from the ACSM/AHA and comprised of lists of common types of physical activity that were stratified by the recommendation from the ACSM/AHA.[26] The Scale is composed of 10 items of physical inactivity behavior. 5-pointLikertscale ranged from never (score 0) to very often (score 4), and score of 30-40 was identified as high risk. The test of S-CVI was 0.87, the Cronbach Alpha coefficient was 0.81, and the test-retest reliability was 0.61.

Part 3: The Sedentary Lifestyle Assessment Form was modified from the Sedentary Assessment of National Center for Health Stratistics.[27] This Form consisted of two sub-sections. The first asked participants in a usual week how many hours they spent sitting or lying down and watching TV, using computer, or others. The times of being sedentary were added up. If the score was^3 7 hour/week, the participants will be classified as sedentary. Sub-section two was the 5-point scale to identify the frequency of sedentary lifestyle. The sedentary subjects were asked to rate their behaviors from never (score 0) to doing every day (score 4), a score of 15-20 was identified as high risk. The test of S-CVI was 1.00, the Cronbach Alpha coefficient was 0.62, and the test-retest reliability was 0.73.

Part 4: The Stressful Lifestyle Assessment Form. This instrument was modified from Suanprung Stress Test-20.[28] This instrument was composed of 20 items on a 5-point Likert scale ranging from do not at all feel (score 0) to extremely feel (score 4). The measure was used to ask participants about their perception of stress during the past 6 months and classified them into score of 60-80 was identified as high risk. The test of S-CVI was 0.98, Cronbach Alpha coefficient was 0.94, and the test-retest reliability was 0.89.

Part 5: The Cigarette Smoking Assessment Form. This instrument was modified from the Smoking Questionnaire from the Central Disease Control,[29] and asked participants to rate their smoking behavior during a six-month period. The Scale was composed of one item on a 5-point scale ranging from not at all smoke (score 0) to frequently smoke (score 4), which classified participants into high risk if their score ≥3 (they smoked sometime to very often). The test of S-CVI was 0.92, Cronbach Alpha coefficient was 0.92, and the test-retest reliability was 0.89.

Part 6: The Alcohol Consumption Assessment Form. This instrument was modified from Wechsler, Dowdall, Davenport and Rimn.[30] The Form asked participants to rate their level of alcohol consumption during a six-month period; from 0 (do not drink) to

4 (they drink sometimes to very often). The test of S-CVI was 0.90, Cronbach Alpha coefficient was 0.92, and the test-retest reliability was 0.88.

2. *The Stages of Change for Physical Activity* was modified from the Stages of Exercise Behavior change of Cardinal,[31] which comprised a 5-item, categorical algorithm whose items and scores reflected each stage of change. Scores ranged from pre-contemplation (score 0 =do not plan to start exercising in the next 6 months) to maintenance (score 4 = do exercise on a regular basis and have been doing so for longer than 6 months). The Scale was incorporated with the recommendation[34] for physical activity and was used to identify the stages of change for moderate and vigorous exercise separately. The test of S-CVI was 1.00, Cronbach Alpha coefficient was 0.78, and the test-retest reliability was 0.62.

3. *The Decisional Balance Scale for Exercise* was modified from the Decisional Balance Scale for Exercise of Jordan, Nigg, Norman, Rossi, and Benisovich.[32] This Scale consisted of two sub-scales (pros and cons of physical activity). Each sub-section was composed of seven items, which ranged from not at all important (score 0) to extremely important (score 4). A score between 0-24% was cut point of low level, 25-49% was mild, 50-74% was moderate, and ≥ 75% was high of pros or cons. The test of S-CVI was 0.90, Cronbach Alpha coefficient was 0.80, and the test-retest reliability was 0.76.

4. A modified version of Bandura's[33] *Physical Activity Self-Efficacy* Scale was used consisting of 18 items, which assess perceived confidence in doing moderate and vigorous exercise in various circumstances. All items ranged from not at all confident (score 0) to extremely confident (score 4). Scores from 0-24% was cut point of low level of self-efficacy, 25-49% were mild, 50-74% moderate, and ≥ 75% high. The test of S-CVI was 0.92, Cronbach Alpha coefficient was 0.92, and the test-retest reliability was 0.62.

5. *The Processes of Change Questionnaire* was modified from the Scale by Nig, Burbank, Padula, Dufresne, Rossi, Velicer, et al.[34] This Scale consisted of 38 items used to assess the five cognitive processes of change (CPOC) and five behavioral processes of change (BPOC) that individuals were asked to recall from the past month and to rate each item on a 5-point Likert scale ranging from never (score 0) to repeatedly (score 4) regarding how frequency each of the processes was used. Scores from 0-24% was cut point of low level of processes of change; 25-49% was mild, 50-74% was moderate, and ≥ 75% was high. The test of S-CVI was 0.97, Cronbach's Alpha coefficient was 0.94, and the test-retest reliability was 0.80.

6. *The Stage of Change for Lifestyle-Related CVRF Scale* was modified for each lifestyle-related CVRF; 1) a limiting high fat and cholesterol diet, 2) a limiting high salt diet, 3) a limiting high sugar diet, 4) a diary vegetable and fruit diet, 5) regular moderate exercise, 6) vigorous exercise, 7) limiting sedentary lifestyle, 8) decreasing stressful lifestyle, 9) giving up cigarette smoking, and 10) giving up alcohol consumption. The Scale used a stages algorithm for behavior change of as designed by Prochaska, Paiva, Padula, Prochaska, Montgomery and Hageman et al.,[38] and which composed of five fixed-definitions stages of changes. The Scale ranged from not think about change behavior in the next 6-month (score 0 = pre-contemplation), do not change behavior but think about change in the next 6-month) to presently do behavior a regularly basis and have been doing so for longer than 6 months (score 4 = maintenance). The test of S-CVI was 0.95, Cronbach Alpha coefficient was 0.78, and the test-retest reliability was 0.62.

Data collection and procedure: After the dissertation proposal was approved by the Faculty of Nursing Ethics Committee, Chiang Mai University, letters from the Faculty of Nursing, was sent to the

directors of the universities asking for the permission of the target university and their faculties to collect the data. After obtaining permission, the researcher contacted the educators in each university that had responsibility for the target samplings to clarify the objectives, and process of the study. Then, the researcher made an appointment with eligible students who met the inclusion criteria and asked them to participate in the study. After agreed to participate and sign the consent form, students receives a package of questionnaires and asked to return to the educators 1-2 week after receiving. The researcher included the appropriated expression to students in the last page of the questionnaires.

Ethical considerations: The researcher asked for permission and approval for the study proposal from the research ethics committee of Faculty of Nursing, Chiang Mai University. An information sheet was given to all eligible participants. They were informed of all aspects and processes of the study. Written informed consent was obtained, the privacy of the participants was protected, and data were coded and processed anonymously.

Data analysis: All of the data were analyzed using statistical computer software. Demographic data, the prevalence and the stages of change of lifestyle-related CVRF were calculated using descriptive statistics. The association between self-efficacy, decisional balance, CPOC, BPOC and the stages of change of physical activity was tested using a multivariate *F*-test (MANOVA) along with Tukey HSD post-hoc analyses, Pearson χ^2-test, multinomial logistic regression (MLR), and corresponding 95% confidence intervals (CI) was also calculated, and η^2 -values provided the effect size estimates for each test. The ability of self-efficacy, decisional balance, CPOC, and BPOC in predicting stages of change in physical activity were examined using MLR.

Results

There were 1,124 subjects (87.81%) that met the eligible criteria and completed the self-reported questionnaires. Half were female (n = 584; 52%) and male (n = 540; 48%) (mean age = 20.65 years). The majority of participants were Thai (n = 1,111; 98.80%) and Buddhist (n = 1,061; 94.40%). Almost of them (n = 849; 75.87%) lived with their father and mother, while only 9.92% (n = 111) lived alone. The majority lived in a municipal area (n = 676; 61.40%). The most prevalent parent occupation was being self-employed or in business (n = 398; 37.02% in father vs. n = 376; 33.50% in mother). Most participants (n = 923; 83.0%) had a family income of higher than 10,000 Baht per month. Most parents (n = 664; 59.93% in father vs. n = 708; 63.61% in mother) were educated at a level lower than a bachelor degree in which the numbers of mother were outweighed than of father.

The results of the prevalence of lifestyle-related CVRF among young adults in the government university of Thailand indicated that the prevalence of unhealthy dietary habits (n = 659; 58.62%), physical inactivity (n = 916; 81.49%, sedentary lifestyle (n = 644; 57.29%), stressful lifestyle (n = 301; 26.78%), cigarette smoking (n = 105; 9.34%), and alcohol consumption (n= 461; 41.01%). Males reported the three highest prevalence of physical inactivity (n = 392; 34.87%), unhealthy dietary habits (n = 335; 29.80), and sedentary lifestyle (n = 300; 26.69%) but female reported the three highest prevalence of physical inactivity (n = 524; 46.62%), sedentary lifestyle (n = 344; 30.60%), and unhealthy dietary habits (n = 324; 28.82%). Males had high prevalence of unhealthy dietary habits, cigarette smoking, and alcohol consumption than females but females had a higher prevalence of physical inactivity and sedentary lifestyle than males. The number of lifestyle-related CVRF among the participants revealed that they had three risks found to

be the most prevalent (n = 338; 30.07%), The second order was two risks (n = 335; 29.80%), and the third was four risks (n = 227; 20.20%). Only ten of the participants (0.89%) reported none of lifestyle-related CVRF.

The results found that most of participants were inactive (pre-contemplation, contemplation, preparation) more than active in stages of action and maintenance. About 78.4% of the participants (n = 882) were being inactive for limiting fat and cholesterol diet, 70.6% of limiting high salt diet (n = 793), 66% of limiting high sugar diet (n = 742), 71% of moderate exercise (n = 802), 78% of vigorous exercise (n = 877), 83% of sedentary lifestyle (n = 932), 63.8% of stressful lifestyle (n = 717), 65% of giving up cigarette smoking (n = 95), 74% of giving up alcohol consumption (n = 413). Most of the participants report being active (n = 650; 57.8%) in daily vegetable and fruit dietary intake (see **Table 1**).

Table 1 Stages of change for lifestyle-related CVRF among students (N = 1,124)

Lifestyle-related CVRF	Stage of change				
	PC n (%)	C n (%)	P n (%)	A n (%)	M n (%)
Unhealthy dietary habits					
Limiting fat and cholesterol	267 (23.8)	256 (22.8)	359 (31.9)	157 (14.0)	85 (7.5)
Limiting high salt diet	318 (28.3)	237 (21.1)	238 (21.2)	160 (14.2)	160 (15.2)
Limiting high sugar food	194 (17.3)	226 (20.1)	322 (28.6)	196 (17.4)	186 (16.5)
Diary, vegetable and fruit diet	61 (5.4)	102 (9.1)	310 (27.6)	274 (24.4)	376 (33.5)
Physical Inactivity					
Moderate physical exercise	87 (7.7)	282 (25.1)	433 (38.5)	223 (19.8)	99 (8.8)
Vigorous physical exercise	263 (23.4)	318 (28.3)	296 (26.3)	172 (15.3)	75 (6.7)
Sedentary lifestyle					
Limiting sedentary lifestyle	219 (19.5)	343 (30.5)	370 (32.9)	129 (11.5)	63 (5.6)
Stressful lifestyle					
Decreasing stressful lifestyle	112 (10.0)	233 (20.7)	372 (33.1)	245 (21.8)	162 (14.4)
Cigarette smoking*					
Giving up cigarette smoking	37 (25.17)	32 (21.77)	26 (17.69)	19 (12.92)	33 (22.45)
Alcohol consumption**					
Giving up alcohol consumption	146 (26.26)	128 (23.02)	139 (25.0)	104 (18.81)	39 (7.01)

Note. * = n = 147, ** n = 556
PC = pre-contemplation stage, C = contemplation, P = preparation, A = action, M = maintenance.

The Pearson Chi-square testing revealed that self-efficacy, pros, cons, CPOC, and BPOC were correlated with stages of change of moderate exercise ($p < 0.001$). Most participants reported in preparation stage they had mild a level of self-efficacy ($\lambda^2 = 67.26$), and cons ($\lambda^2 = 47.26$), but had moderate level of pros, CPOC ($\lambda^2 = 53.24$), and BPOC ($\lambda^2 = 104.71$). For stages of vigorous exercise change, most of the TTM constructs correlated with stages of vigorous exercise change ($p<0.001$), except cons ($\lambda^2 = 29.88$, $p<0.01$).

For the crosstabulation between stages of change for lifestyle-related CVRF across the stages of moderate exercise change, most of participants reported in the preparation stage across with preparation stages of all lifestyle-related CVRF. Stages of change for moderate exercise correlated with stages of change for lifestyle-related CVRFs ($p< 0.001$, and $p < 0.01$ for limiting fat and cholesterol diet), except giving up cigarette smoking ($\chi^2 = 22.81$, $p = 0.119$) and giving up alcohol consumption ($\chi^2 = 22.5$, $p = 0.061$). For the stages of change for vigorous exercise across stages of change of lifestyle-related CVRF, most of the participants reported being in the preparation stage of vigorous exercise across with preparation stages of lifestyle-related CVRF ($p< 0.01$), except stages of change of limiting high salt diet, limiting high sugar diet, and daily vegetable and fruit diet ($p<0.001$).

Table2 displays the results of the Tukey's *post hoc* test to differentiate of the TTM variables across the stages of moderate exercise change. The data presented mean differences for every possible paired combination of the highest degree attained. The data revealed that self-efficacy, pros, cons, CPOC, BPOC of that maintenance stage differs from pre-contemplation, contemplation, and action stages ($p< 0.001$ and $p< 0.01$). BPOC was the highest effect size ($F = 23.97$, partial $\eta^2 = 0.079$, $p< 0.001$). CPOC showed lower effect size more likely than BPOC (partial $\eta^2 = 0.038$, $p< 0.001$). For the sub-variable, self-liberation presented the highest effect size ($F = 27.43$, partial $\eta^2 = 0.090$, $p< 0.001$).

For the stages of change of vigorous exercise, all the major variables analyses were statistically significant ($p < 0.001$). The participants reported being in action and maintenance stages and had more self-efficacy, pros, CPOC, BPOC, and lower cons than those participants at the pre-contemplation, contemplation, and preparation stage. No significant differences were found between action and maintenance stage for any of TTM constructs. BPOC presented the highest effect size ($F = 27.11$, partial $\eta^2 = 0.089$, $p< 0.001$). Regarding CPOC, this showed lower effect size more likely than BPOC (partial $\eta^2 = 0.032$ vs. partial $\eta^2 = 0.089$, $p< 0.001$). For the sub-variables of CPOC and BPOC, self-liberation presented the highest effect size ($F = 30.17$, partial $\eta^2 = 0.098$, $p< 0.001$)(see **Table 3**).

The multinomial logistic regression test revealed that the TTM constructs had affected the stages of change of physical activity. Cons was the highest affected of all the stages of moderate and vigorous exercise change. The odds ratio of the cons from pre-contemplation to action stage was 4.96, 3.45, 2.57, 2.11 ($p <0.001$) for moderate exercise and it was 3.42, 2.48, 2.33 ($p <0.001$), and 1.83 ($p<0.01$) for vigorous exercise. Overall the predicting of stages of moderate and vigorous exercise change was 41.1% vs. 34.9%. Preparation stage was the highest of prediction value (89.8% for moderate exercise vs. 51.4% for vigorous exercise) (see **Table 4-5**).

Table 2 Comparison of means and standard deviations of the TTM constructs across the stages of change for moderate physical exercise

Variables	Stages of vigorous exercise change					F	η^2	Tukey's HSD
	PC	C	P	A	M			
	Mean (SD)							
SE	1.53	1.57	1.77	1.82	2.05	13.35***	0.046	PC C < P A M
	0.76	0.64	0.59	0.73	0.77			M > PC C P A
Pros	0.49	2.58	2.70	2.76	3.19	14.66***	0.050	PC C P < A M
	0.85	0.78	0.72	0.77	0.64			A < M
Cons	1.60	1.32	1.27	1.20	0.91	10.04***	0.035	PC > C P A M
	0.83	0.78	0.76	0.76	0.73			C P A > M
CPOC	1.82	1.96	2.17	2.12	2.29	11.09***	0.038	PC C < P A M
	0.65	0.59	0.59	0.71	0.72			
CR	1.87	1.94	2.14	2.09	2.31	5.84***	0.210	PC C < M
	0.82	0.74	0.79	0.90	0.96			P > C, Non A
DR	2.01	2.14	2.31	2.25	2.35	3.71**	0.013	PC < P
	0.81	0.87	0.79	0.89	0.98			Non C A M
ER	1.64	1.75	1.97	1.93	1.94	4.92**	0.017	PC C < P
	0.78	0.88	0.78	0.87	1.01			Non A, Non M
SR	1.70	1.89	2.13	2.10	2.37	14.01***	0.048	PC C < P A M
	0.83	0.71	0.70	0.80	0.87			P A < M
SoL	2.00	2.17	2.36	2.31	2.57	8.38***	0.029	PC < P A M
	0.76	0.74	0.76	0.82	0.86			C < P M, A< M
BPOC	1.72	1.79	2.08	2.13	2.36	23.97***	0.079	PC < P A M
	0.79	0.60	0.59	0.65	0.65			P A < M
CC	1.97	2.05	2.32	2.39	2.80	21.16***	0.071	PC C < P A M
	0.95	0.79	0.76	0.82	0.75			P A < M
HR	1.66	1.62	1.91	1.90	1.91	6.86***	0.024	C < P A M
	0.87	0.83	0.78	0.87	0.93			
RM	1.79	1.93	2.23	2.27	2.51	19.06***	0.064	PC C < P A M
	0.86	0.72	0.72	0.76	0.85			P < M
SeL	1.85	1.99	2.30	2.42	2.82	27.43***	0.090	PC C < P A M
	0.99	0.78	0.77	0.83	0.84			P A < M
SC	1.34	1.37	1.61	1.67	1.77	7.55***	0.026	PC < A M
	1.03	0.80	0.84	0.87	0.89			C < P A M

Note. *** Correlation is significant at the p< 0.001 level (2-tailed).

** Correlation is significant at the p< 0.01 level (2-tailed).

PC = Pre-contemplation, C = Contemplation, P = Preparation, A = Action, M = Maintenance, SE = Self-Efficacy, CPOC = Cognitive processes of change, BPOC = Behavioral processes of change, CR = Consciousness raising, DR = Dramatic relief, ER = Environmental reevaluation, SR = Self-reevaluation, SoL = Social liberation, CC = Counter conditioning, HR = Helping relationships, RM = Reinforcement management, SeL = Self-liberation, and SC = Stimulus control

Table 3 Comparison of means and standard deviations of the TTM constructs across the stages of change for vigorous physical exercise

Variables	Stages of vigorous exercise change					F	η^2	Tukey's HSD
	PC	C	P	A	M			
	Mean (SD)							
SE	1.43	1.72	1.86	1.87	2.08	23.73***	0.079	PC < C P A M
	0.64	0.62	0.58	0.73	0.86			C < M
Pros	2.57	2.69	2.70	2.76	3.15	8.82***	0.031	PC C P A < M
	0.80	0.71	0.75	0.80	0.75			
Cons	1.33	1.26	1.32	1.19	0.96	4.27***	0.015	PC C P > M
	0.78	0.76	0.76	0.84	0.68			Non A
CPOC	1.91	2.09	2.20	2.11	2.28	9.11***	0.032	PC < C P A M
	0.61	0.59	0.58	0.75	0.80			
CR	1.90	2.06	2.21	2.05	2.25	5.92***	0.021	PC < C M
	0.81	0.75	0.78	0.92	1.04			Non A
DR	2.10	2.28	2.34	2.18	2.27	3.08*	0.011	PC < P
	0.85	0.83	0.80	0.90	1.00			Non A M
ER	1.67	1.89	1.97	1.95	2.07	6.31***	0.022	PC < C P A M
	0.81	0.84	0.78	0.91	1.03			
SR	1.79	2.02	2.19	2.12	2.40	15.04***	0.051	PC < C P A M
	0.76	0.70	0.66	0.87	0.92			C < P M
SoL	2.20	2.29	2.34	2.28	2.48	2.17ns	0.008	Non PC C P A M
	0.79	0.77	0.74	0.84	0.90			
BPOC	1.72	1.96	2.16	2.17	2.35	27.11***	0.089	PC < C P A M
	0.68	0.57	0.57	0.65	0.73			C < P A M
CC	1.96	2.23	2.38	2.45	2.84	23.34***	0.077	PC < C P A M
	0.83	0.80	0.72	0.83	0.76			C P A < M
HR	1.63	1.75	1.96	1.94	1.91	7.28***	0.026	PC < P A, C < P
	0.86	0.81	0.75	0.85	1.04			Non M
RM	1.87	2.10	2.29	2.32	2.47	17.58***	0.059	PC < C P A M
	0.81	0.68	0.70	0.76	0.96			C < P A M
SeL	1.86	2.19	2.41	2.47	2.80	30.17***	0.098	PC < C P A M
	0.85	0.793	0.73	0.81	0.96			C < P A M
SC	1.30	1.48	1.75	1.68	1.72	12.31***	0.042	PC < P A M
	0.90	0.79	0.83	0.87	0.96			C < P

Note. * Correlation is significant at the p< 0.05 level (2-tailed).
*** Correlation is significant at the p< 0.001 level (2-tailed).
ns = non significant

PC = Pre-contemplation, C = Contemplation, P = Preparation, A = Action, M = Maintenance, SE = Self-Efficacy, CPOC = Cognitive processes of change, BPOC = Behavioral processes of change, CR = Consciousness raising, DR = Dramatic relief, ER = Environmental reevaluation, SR = Self-reevaluation, SoL = Social liberation, CC = Counter conditioning, HR = Helping relationships, RM = Reinforcement management, SeL = Self-liberation, and SC = Stimulus control.

Table 4 Parameter estimates: the relationships between self-efficacy, pros, cons, and processes of change constructs and stages of change for moderate physical exercise.

Stages of change	variables	B	SE	Wald	Sig.	Exp(B)	95%CI for Exp(B)	
							Lower Bound	Upper Bound
Pre-contemplation	SE	-.189	0.27	0.49	.484	0.83	0.49	1.40
	Pros	0.01	0.20	0.00	.961	1.01	0.68	1.51
	Cons	1.60	0.21	61.1	.000	4.96	3.32	7.41
	CPOC	0.26	0.38	0.45	.501	1.29	0.61	2.71
	BPOC	-1.24	0.37	11.1	.001	0.29	0.14	0.60
Contemplation	SE	-.097	0.21	0.23	.635	0.91	0.61	1.36
	Pros	0.13	0.16	0.60	.438	1.14	0.82	1.56
	Cons	1.24	0.17	54.3	.000	3.45	2.48	4.79
	CPOC	1.02	0.30	11.7	.001	2.76	1.54	4.95
	BPOC	-1.38	0.30	21.7	.000	0.25	0.14	0.45
Preparation	SE	0.00	0.19	0.00	.998	1.00	0.69	1.45
	Pros	-0.14	0.15	0.86	.353	0.87	0.64	1.17
	Cons	0.94	0.16	35.4	.000	2.57	1.88	3.50
	CPOC	1.00	0.28	13.0	.000	2.70	1.58	4.64
	BPOC	-0.64	0.27	5.61	.018	0.53	0.31	0.90
Action	SE	0.05	0.20	0.06	.813	1.05	0.71	1.56
	Pros	-0.11	0.16	0.48	.490	0.89	0.65	1.23
	Cons	0.75	0.17	19.8	.000	2.11	1.52	2.93
	CPOC	0.30	0.29	1.05	.305	1.35	0.76	2.39
	BPOC	-0.20	0.29	0.47	.495	0.82	0.47	1.44

Note. *df = 1,* significant 2-tailed
The reference category is: maintenance stage.
SE = self-efficacy,
CPOC = cognitive processes of change,
BPOC = behavior processes of change.

Table 5 Parameter estimates: the relationships between self-efficacy, pros, cons, and processes of change constructs and stages of change for vigorous physical exercise.

Stages of change	Variables	B	SE	Wald	Sig.	Exp (B)	95% CI for Exp (B)	
							Lower Bound	Upper Bound
Pre-contemplation	SE	-0.65	0.23	7.85	.005	0.52	0.33	0.82
	Pros	0.46	0.18	6.26	.012	1.58	1.10	2.26
	Cons	1.23	0.18	45.8	.000	3.42	2.40	4.89
	CPOC	0.99	0.33	8.92	.003	2.68	1.40	5.11
	BPOC	-1.28	0.33	15.2	.000	0.28	0.15	0.53
Contemplation	SE	-0.12	0.22	0.32	.575	0.89	0.58	1.36
	Pros	0.16	0.18	0.78	.377	1.17	0.83	1.65
	Cons	0.91	0.17	27.2	.000	2.48	1.76	3.50
	CPOC	1.01	0.32	10.1	.001	2.73	1.47	5.08
	BPOC	-0.97	0.32	9.47	.002	0.38	0.21	0.70
Preparation	SE	-0.03	0.22	0.12	.900	0.97	0.64	1.49
	Pros	-0.18	0.18	1.04	.307	0.83	0.59	1.18
	Cons	0.84	0.17	23.6	.000	2.33	1.65	3.27
	CPOC	0.73	0.32	5.39	.020	2.08	1.12	3.86
	BPOC	-0.30	0.31	0.93	.335	0.74	0.40	1.36
Action	SE	0.01	0.23	0.00	.981	1.01	0.64	1.57
	Pros	-0.07	0.19	0.12	.726	0.94	0.65	1.35
	Cons	0.60	0.18	10.8	.001	1.83	1.28	2.62
	CPOC	0.02	0.33	0.01	.943	1.02	0.54	1.95
	BPOC	0.12	0.33	0.14	.706	1.13	0.60	2.14

Note. *df = 1* The reference category is: maintenance stage, significant 2-tailed
SE = self-efficacy,
CPOC = cognitive processes of change,
BPOC = behavior processes of change

Discussion

Results from studies have indicated that various types of socio-demographic characteristics are associated with lifestyle-related CVRF. For example, in the USA, studies reported on physical inactivity more common among females than males, and among elder students than younger ones, among low-income families than those with higher income, and among the less-educated than higher-educated adults.[35] The university students in this study who came from higher socioeconomic backgrounds tended to have higher levels of CVRF. In addition, the majority of the participants were healthy, so they paid little attention to their own health, for example, not checking their blood pressure, blood sugar, or blood cholesterol level. These data support evidence of unattended cardiovascular risk among Thai young adults.

For the prevalence of lifestyle-related CVRF, the results supported the fact that the participants had high prevalence of three CVRF including physical inactivity, sedentary lifestyle, and unhealthy dietary habits. Having multiple risk factors were distributed in both males and females from the first-to-fourth year of university students. Comparing males and females, the prevalence of physical inactivity and sedentary lifestyle was higher in females. Being physical inactive among university students may be partly due to life in university where the studying time is occupied by social activities such as being with friends, talking on the telephone, using the Internet, and drinking alcohol.[37] This result was different from other studies in the US. The low prevalence in our Thai sample may be due to a specific social norm on valuing slender figures so Thai teenagers usually control their weight.

For stages of change, data from the present study showed that most participants were at the inactive stages for most of all lifestyle-related CVRF, except daily vegetable and fruit diet intake. Compared with a study in Germany, the majority of students in inactive stages in fruit and vegetable intake (96.3%), physical exercise (59.6%), smoking (65.4%), and binge drinking (91.1%).[36] Focusing on the stages of change for physical activity, the present study showed that most of the participants were at the inactive stages. Moreover, female students presented more inactive stages than male students. The gender differences regarding physical activity demonstrated in this study were consistent with previous investigation of multiple-age cohorts which reported that males were consistently more active than females.[37]

There are several reasons for being inactive in physical activity. It has been found that college students perform little exercise because of not having enough time; studying hard; no place to exercise; not finding an appropriate type of exercise; not have any friends to do it with; that the culture and environment of each university were not conductive to exercise[16]; and they had very low perception of the influencing factors such as perceiving pros and cons, self-efficacy, interpersonal support, and motivation.[15] Furthermore, physical exercise often was seen as play and was considered less important than studying. In addition, few universities have a comprehensive physical education program, a fact that relates to the low priority given to physical activity in educational policy. Especially, universities did not set time for exercise or encourage students to exercise. Most of Thai students in this study or the previously mentioned study complained that they did not have free time to exercise because they studied hard all the days of the week.

Regarding the correlation between stages of change for physical inactivity and those of other lifestyle-related CVRF, the data revealed that stages of change for moderate exercise had correlated with stages of change of other lifestyle-related CVRFs, except giving up cigarette smoking ($p = 0.119$) and giving up alcohol consumption ($p = 0.061$). For the stages of change for vigorous exercise and lifestyle-related

CVRF, most of participants reported being in preparation stage of vigorous exercise and preparation stage for other lifestyles (limiting fat and cholesterol diet, limiting sedentary lifestyle, decreasing stressful lifestyle ($p < 0.001$), and giving up alcohol consumption ($p < 0.01$). They were in contemplation stage of vigorous exercise with preparation stage of limiting high sugar diet, and maintenance stage of diary vegetable and fruit diet intake. Most of participants were in pre-contemplation stage of vigorous exercise with contemplation stage of giving up cigarette smoking, and giving up alcohol consumption ($p < 0.01$).

The analysis revealed that self-efficacy, pros, cons, CPOC, and BPOC were correlated with stages of moderate exercise. Most participants at the preparation stage exhibited a moderate level of self-efficacy, pros, CPOC, and BPOC but a mild level of cons. All of the TTM variables were correlated with stages of change of vigorous exercise. Most participants were at the contemplation stage of vigorous exercise exhibited a mild level of self-efficacy and cons, and moderate pros and CPOC and most participants at the preparation stage exhibited moderate BPOC. According to the TTM, progression through the stages of change was linked with self-efficacy, decisional balance, and the processes of change. The results of this present study supported the TTM, self-efficacy of the participants increased toward from the pre-contemplation to the maintenance stage. In addition, the pros increase toward stages of moderate exercise change from the pre-contemplation to the maintenance stage and the cons decrease toward stages. This means that helping individuals to make better decisions involved focusing on just the pros and cons of changing.

Furthermore, the results from this study contrasted with previous studies in that participants at inactive stages used the BPOC more than the CPOC. Further, participants were at inactive stages of moderate exercise used self-liberation and stimulus control more than at the active stages. Dramatic relief appeared to be significant at the contemplation and preparation stages. Regarding, vigorous exercise, dramatic relief was significant from the pre-contemplation to preparation stages, while social-liberation, counter conditioning, and self-liberation was significant at the pre-contemplation and contemplation stages.

Finally, the CPOC was significant at the contemplation and preparation stages, and the BPOC was significant at the pre-contemplation toward the preparation stage. Interestingly, regarding processes of change, for Thai students there were not significant relationships at the action and maintenance stages. Regarding these differences from previous studies, the reasons may be that the processes of change were related with relationship, facility provide about place of exercise, policy, time, or environment of each university.

Implications for Practice

The study results are beneficial for nursing professionals and nursing educators to allocate knowledge in course work and to set about promoting a healthy lifestyle program in universities. However, the TTM factors from this study showed a correlation in the stages of change. Prospective interventions using influencing factors as the key to lifestyle-related CVRF change are necessary among university students. From this based of knowledge, develop models of combinations of interventions (policy, environmental, health systems) to address lifestyle-related CVRF in diverse settings and evaluate their effectiveness are necessary.

Limitations and recommendation

This study was obtaining data from eight government universities in Thailand; therefore, the generalizability of the findings may be limited in that participants were not drawn from autonomous, private, or open universities. Further study is recommended

in order to investigate the whole of young adults especially in college or vocational educations. Data were based on self-reports, and there may have been some misclassifications. The study was based variable on frequency of lifestyle-related CVRF; therefore it is unclear how the absence of duration and/or quality data may have affected the results.

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ความชุก ระยะการเปลี่ยนแปลงของปัจจัยเสี่ยงโรคหัวใจและหลอดเลือดด้านแบบแผนชีวิตและปัจจัยทำนายที่มีอิทธิพลต่อกิจกรรมทางกายในผู้ใหญ่ไทยตอนต้น

สุนทรา เลี้ยงเชวงวงศ์, ลินจง โปธิบาล, ศิริรัตน์ ปานอุทัย, พิกุล บุญช่วง

บทคัดย่อ: การวิจัยเชิงพรรณนาหาความสัมพันธ์นี้มีวัตถุประสงค์เพื่อศึกษาความชุกระยะการเปลี่ยนแปลงของปัจจัยเสี่ยงโรคหัวใจและหลอดเลือดด้านแบบแผนชีวิต ทดสอบความสัมพันธ์และอำนาจในการทำนายการปรับเปลี่ยนการทำกิจกรรมทางกายตามแนวคิดการปรับเปลี่ยนพฤติกรรมในวัยผู้ใหญ่ตอนต้นไทยคัดเลือกกลุ่มตัวอย่างโดยวิธีสุ่มตัวอย่างแบบแบ่งสัดส่วนหลายขั้นตอน จากนักศึกษามหาวิทยาลัยของรัฐบาล 8 แห่ง ชั้นปีที่ 1-4 จำนวน 1,124 คน วิเคราะห์ข้อมูลด้วยสถิติเชิงพรรณนา ทดสอบสถิติสหสัมพันธ์เพียร์สันไคว์ส-แคว ความแปรปรวนพหุคูณและความถดถอยโลจิสติค

ผลการศึกษา พบว่านักศึกษามหาวิทยาลัยมีความชุกของปัจจัยเสี่ยงด้านแบบแผนชีวิตคือ การมีกิจกรรมทางกายน้อยร้อยละ 81.49 การรับประทานอาหารไม่เหมาะสมร้อยละ 58.62 การมีแบบแผนชีวิตนั่งๆ นอนๆ ร้อยละ 57.29 การดื่มสุราร้อยละ 41.01 มีความเครียดร้อยละ 26.78 และการสูบบุหรี่ร้อยละ 9.34 นักศึกษาส่วนใหญ่มีปัจจัยเสี่ยงด้านแบบแผนชีวิตอยู่ในระยะไม่มีการปรับเปลี่ยนพฤติกรรม ลักษณะการกระจายของระยะการเปลี่ยนแปลงพฤติกรรมคล้ายกันทั้งเพศชายและเพศหญิง และชั้นปีที่ 1 ถึง 4 ทั้งนี้ระยะการเปลี่ยนแปลงของปัจจัยเสี่ยงด้านแบบแผนชีวิตทั้งหมดมีความสัมพันธ์กับระยะการเปลี่ยนแปลงของการทำกิจกรรมทางกาย ($p < 0.001$) ปัจจัยตามแนวคิดการปรับเปลี่ยนพฤติกรรมคือการรับรู้ความสามารถของตนเอง การตัดสินใจด้านโทษ การตัดสินใจด้านประโยชน์ และกระบวนการเปลี่ยนแปลงมีความสัมพันธ์กับระยะการเปลี่ยนแปลงของการทำกิจกรรมทางกาย โดยเฉพาะการตัดสินใจด้านโทษมีผลกระทบสูงที่สุดต่อทุกระยะการเปลี่ยนแปลงการทำกิจกรรมทางกาย ข้อเสนอแนะจากการศึกษาควรให้ความสำคัญและมีการรณรงค์เพื่อป้องกันโรคหัวใจและหลอดเลือดในกลุ่มวัยนี้โดยเฉพาะพยาบาลส่งเสริมสุขภาพบุคลากรด้านสุขภาพและอาจารย์พยาบาลในมหาวิทยาลัย

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คำสำคัญ: ระยะการเปลี่ยนแปลงพฤติกรรม แนวคิดการปรับเปลี่ยนพฤติกรรม แบบแผนชีวิต ปัจจัยเสี่ยงโรคหัวใจและหลอดเลือด การทำกิจกรรมทางกาย วัยผู้ใหญ่ตอนต้น

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