

## Original Article

# A survey of Transitional Shifts in Physical Activity Behavior among Employees of Birjand Universities Based on Transtheoretical Model, A Longitudinal Study, Iran, 2014

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**Received:** 2016/06/07

**Accepted:** 2016/08/30

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### Abstract

**Introduction:** Trans theoretical model (TTM) is one of the models applied to assess the physical activity behavior. One of the criticisms leveled at studies conducted on the trans theoretical model is that majority of them have employed cross-sectional designs so that they fail to show the dynamic nature of change. Thus, the aim of the current study was to investigate transitional shifts in Physical Activity Behavior among employees of Birjand universities based on Transtheoretical Model.

**Materials & Methods:** This prospective study with six months of follow-up was conducted on 200 employees of Research and Education departments of Birjand Universities of medical sciences. A total number of 179 participants completed the questionnaires at two time periods, i.e., at the baseline and six months later. The instrument for data collection was a questionnaire consisting of demographic variables and constructs of Transtheoretical model which was completed by using the self-reported method.

**Results:** Transitional shifts in physical activity behavior were classified into four patterns: stable sedentary (26.3%), stable active (39.1%), exercise adopters (12%), and exercise relapsers (22.6%). Stable active group had a significant decrease in the mean score of pros. Exercise adopters had a significant increase in the mean scores of self-efficacy and pros. Also, significant decreases were observed in the mean scores of behavioral processes, cognitive processes, and self-efficacy among exercise relapsers. Mean scores of the pros, self-efficacy, behavioral and cognitive processes at the baseline and follow-up showed significant differences between the four patterns.

**Conclusion:** The results of this study provided partial support for internal validity of TTM. It seems that interventions based on this model can be effective in adopting and maintaining physical activity behavior.

**Keywords:** Transtheoretical model, Stage of change model, Physical activity behavior, Behavior change, Transitional shifts.

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## Introduction

As the fourth cause of mortality, inactivity leads to death of 3.2 million people across the world every year <sup>[1]</sup>. The data from the Third National Surveillance of Risk Factors of Non-Communicable Diseases in 2007, which was conducted on 4120 Iranians aged 15-64, indicated that 40% of Iranian adults did not have sufficient physical activity <sup>[2]</sup>. Studies conducted on the employees working in Iranian universities showed that over 65% of them lack sufficient physical activity <sup>[3-5]</sup>. Nonetheless, physical activity can bring 60 different health promoting benefits to the body. That is why health-care providers and researchers attempt to promote physical activity based on psychological theories <sup>[6]</sup>. Among the models which have promised more support for physical activity behavior, the Trans theoretical model (TTM) is the only multistage one <sup>[7]</sup>. The model includes four core constructs, namely stages of change, decisional balance, processes of change, and self-efficacy <sup>[8]</sup>. Decisional balance shows the individual's relative weighing of the pros and cons of behavioral changing <sup>[9]</sup>. Self-efficacy features a person's perceived ability to perform on a high-risk task without returning to previous behaviors <sup>[10]</sup>. Processes of change involve 10 processes derived from Psychotherapy Model which are categorized into two sets of processes: cognitive (i.e., conscious raising, dramatic relief, environmental reevaluation, self-reevaluation, and social liberation) and behavioral (i.e., counterconditioning, relationships' improvement, reinforcement management, self-liberation, and stimulus control) <sup>[11]</sup>. Stages of change are the core construct of this model and involve the five stages of Precontemplation,

contemplation, preparation, action, and maintenance <sup>[12]</sup>. These stages reflect the individual's motivational readiness for behavioral change <sup>[13]</sup>. In Transtheoretical model (TTM), one does not necessarily go along these stages in a linear fashion; it can be in a circular mode <sup>[7]</sup> so that an individual might go through the previous stages before grasping the maintenance stage <sup>[14]</sup>. As opposed to other theories such as the health belief model and the social cognitive theory which traditionally apply static constructs, the TTM emphasizes on dynamic variables <sup>[15]</sup>. This emphasis on the dynamic nature of health behavioral change is considered as a strong point of this model <sup>[16]</sup>. One of the criticisms leveled at studies conducted on the transtheoretical model is that majority of them have employed cross-sectional designs <sup>[17]</sup>. This type of studies not only yields the weakest results for the TTM, but also fails to show the dynamic nature of behavior change <sup>[18]</sup>. Longitudinal studies are required to properly understand behavior change based on this model <sup>[19]</sup>. In this line, some researchers have attempted to conduct longitudinal interventions based on this model in different populations with regard to exercise <sup>[20]</sup>, nutritional <sup>[17]</sup>, and smoking <sup>[12]</sup> behaviors to focus on the perceived patterns of transitional shifts along the stages of change. Researchers have used different patterns to categorize people in terms of physical activity behaviors. For example, Callaghan et al. built stable sedentary, stable active, exercise relapsers, and exercise adopters patterns to categorize individuals <sup>[20]</sup>. These patterns have been applied in a number of other longitudinal studies in the area of physical activity behavior <sup>[21, 22]</sup>. Levy et al. also used stable sedentary, stable active,

activity relapsers, activity adopters, and perpetual preparers patterns to classify individuals <sup>[13]</sup>.

Application of these patterns appears to depend on different factors including follow-up interval, sample size, and the purpose of the study. Cardinal et al. maintained that based on this model at least a six-month period is required to allow for a complete progress of individuals during the change stages in the longitudinal studies <sup>[18]</sup>. It is because of that even in the linear process of change; at least a six-month period is needed for an individual to shift from the Precontemplation to the maintenance stage <sup>[13]</sup>. In addition, the interrelationship between TTM variables may be influenced by cultural differences <sup>[20]</sup>.

A study of transitional patterns across the physical activity stages of change can yield a better picture of physical activity behavior and help identify the factors affecting these patterns. This can in turn act as a guide for researchers and policy-makers to implement practical interventions better. Given what went above and the scarce number of longitudinal studies based on TTM in Iran as the literature suggests, this study aimed to survey transitional shifts in physical activity behavior among university employees of Birjand, Iran, based on TTM in 2014.

## Materials & Methods

This was a longitudinal study of the physical activity behavior determinants. The objectives of this study were initially explained to the participants and they were assured that all aspects of their information are treated as confidential. Upon obtaining informed consent from the

participants, they were provided with the questionnaires. The target population included all the employees (n=200) of the education and research departments of the four universities in Birjand (i.e., University of Medical Sciences; Azad University; Birjand State University; and the Industrial University). The questionnaires were administered two times with a six-month interval to complete. The preliminary data were collected in mid-April and the follow-up data in mid-October. From 200 participants 179 completed both questionnaires, leaving out the incomplete ones, 172 questionnaires were left for final analysis. The measure included a demographics form (i.e. age, gender, and marital status) as well as a TTM questionnaire. To determine stages of change, Marcus et al. scale <sup>[23]</sup>, was applied. In terms of physical activity behavior, this scale states that individuals will be in either one of the five stages of pre-contemplation, contemplation, preparation, action, or maintenance on the TTM questionnaire. Kappa coefficient was calculated as 0.78 during a two-week time-span in previous studies. The criterion for physical activity was set as an activity performed at least 3-5 times a week, each time lasting 30 minutes so that it could increase heart beat and respiration leading to perspiration such as brisk walking or cycling. The questionnaires used by Moeini et al. <sup>[10]</sup>, were applied to measure decisional balance, processes of change, and self-efficiency. The decisional balance scale consisted of 17 items which measured the cons and pros of physical activity from the participants' viewpoints on a 5-item Likert scale ranging from It is not important at all <sup>[1]</sup> to It is Extremely important <sup>[5]</sup>. Nine items

concerned the pros and 8 items dealt with the cons of physical activity.

The processes of change scale included 18 items out of which 10 items were related to cognitive processes and 8 items to behavioral processes. These items measured the frequency of applying processes of change on a 5-item Likert scale from Never <sup>[1]</sup> to Repeatedly <sup>[5]</sup> and the total scores related to this section could range from 18 to 90. The self-efficacy scale included 11 items which measured the individuals' abilities to perform physical activities under different circumstances by using a 5-item Likert scale from Not at all confident <sup>[1]</sup> to Completely confident <sup>[5]</sup>. Its score ranged from 11 to 55. The reliability of the scales was confirmed by calculating Cronbach's alpha and correlation coefficient through test-retest method.

The questionnaires were first given to and completed by 20 employees of the universities twice within 2 weeks. Further, Kappa coefficient was calculated as 0.70 for the self-efficacy scale the correlation coefficient was  $r=0.73$  for the decisional balance index,  $r=0.79$  for the processes of change index, and  $r=0.82$  for the self-efficacy scale. Cronbach's alpha for the pros, cons,

cognitive processes of change, behavioral processes of change, and self-efficacy of the 172 participants were respectively 0.92, 0.75, 0.83, 0.85, and 0.92 at the beginning of the study. In the follow-up, they were 0.90, 0.73, 0.81, 0.85, and 0.91. The data were analyzed in SPSS software (version 16) using paired t-test and ANOVA, and the significant level was set at  $p<0.05$ .

### Results

The participants ranged from 24 to 60 years old ( $M=37.8$ ,  $SD=9$ ); 142 of whom (82.6%) were married and 93 of them (54.1%) were women.

As Table 1 shows, there was no shift from precontemplation to preparation, from contemplation to maintenance, or from maintenance to action during the six months of time span. In addition, in all the stages of change except for the action stage, the majority of participants were still in their previous stage. In the action stage, majority of the subjects had entered the maintenance stage.

**Table 1.** Shifts in stages of change along the six-month follow-up

	Follow up					
	Precontemplation	Contemplation	Preparation	Action	Maintenance	Total
Baseline	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Precontemplation	13(59.1)	5(22.7)	0	2(9.1)	2(9.1)	22(100)
Contemplation	13(27.7)	22(46.8)	11(23.4)	1(2.1)	0	47(100)
Preparation	7(13.5)	11(21.2)	27(51.9)	5(9.6)	2(3.8)	52(100)
Action	1(7.7)	3(23.1)	3(23.1)	1(7.7)	5(38.5)	13(100)
Maintenance	1(2.6)	7(18.4)	6(15.8)	0	24(63.2)	38(100)
Total	35(20.3)	48(27.9)	47(27.3)	9(5.2)	33(19.2)	172(100)

To perform statistical analyses and compare results with those of the previous studies, in the current studies employees were divided into four groups according to their change stages in physical activity – similar to the categorization made in Callaghan et al. study:

Stable sedentary: individuals in precontemplation and contemplation stages at both points of time (n=35, 26.3%) ; stable active: individuals in preparation, action, and maintenance stages at both points of time (n=52, 39.1%); exercise adopters: individuals in precontemplation and contemplation stages at the beginning of the study but in preparation, action, and maintenance stages at the end of the study (n=16, 12%); and exercise relapsers: individuals in preparation, action, and maintenance stages at the beginning of the study but in precontemplation and contemplation stages at the end of the study (n=30, 22.6%) .

This manner of categorization excluded out 39 participants 21 of whom were women. These involved subjects who shifted from precontemplation to contemplation, from preparation to action, and from action to maintenance stages and vice versa.

Table 2 indicates that there is a significant difference between the mean scores of pros in stable active and exercise adopters groups, between self-efficiency mean scores in exercise adopters and exercise relapsers, between the behavior processes' mean score in exercise relapsers, and between the mean score of cognitive processes in exercise relapsers from the onset of the study until the end of it.

Mean scores of the cons at the onset and end of the study were significantly different in terms of transitional shifts' patterns. At the onset, the mean

score of pros in the stable sedentary group was significantly less than those of stable active and exercise relapsers individuals. Besides, the mean score of pros in the exercise adopters was significantly less than that of stable active individuals. At the follow-up, the mean score of pros in the stable sedentary group was significantly less than that of the stable active group.

At the follow-up, the mean score of behavioral processes in the stable sedentary group was significantly less than that of the stable active one. Furthermore, the mean score of behavioral processes in the exercise relapsers and adopters was significantly less than that of the stable actives. At the onset, the mean score of behavioral processes in the stable sedentary group was significantly less than those of stable actives and relapsers. The mean score of cognitive processes in the exercise adopters was significantly less than that of stable actives. At the follow-up, the mean score of cognitive processes in the stable sedentary group was significantly less than the mean score of stable actives. At the onset, the mean score of self-efficiency in the stable sedentary group was significantly less than mean scores of the stable actives and relapsers. Furthermore, the mean score of self-efficacy in the exercise adopters was significantly less than that of the stable actives. At the follow-up, the mean score of self-efficiency in the stable sedentary group was significantly less than those of the stable actives and exercise adopters. Besides, the mean score of self-efficacy in the exercise relapsers was significantly less than the mean scores of the stable actives and exercise adopters

**Table 2.** Scores on TTM variables at baseline and follow-up in each of the four patterns

Variables	TIME	Stable	Stable	Exercise	Exercise	ANOVA	Tukey
		sedentary	active	adopters	relapsers		
Pros	Baseline	3.28(0.80)	3.97(0.78)	3.24(0.88)	3.81(0.76)	<b>P&lt;0.001*</b>	SS<SA,ER EA<SA
	Follow up	3.17(0.75)	3.69(0.86)	3.69(0.64)	3.50(0.93)	<b>P=0.03*</b>	SS<SA
	<b>Paired t- test</b>	<b>P=0.35</b>	<b>P=0.03*</b>	<b>P=0.04*</b>	<b>P=0.09</b>		
Cons	Baseline	1.92(0.56)	1.66(0.41)	1.98(0.58)	1.71(0.51)	<b>P=0/04*</b>	-
	Follow up	1.85(0.63)	1.60(0.42)	1.73(0.57)	1.76(0.49)	<b>P=0.14</b>	-
	<b>Paired t- test</b>	<b>P=0.41</b>	<b>P=0.40</b>	<b>P=0.20</b>	<b>P=0.57</b>		
SE	Baseline	2.05(0.68)	2.98(0.82)	2.18(0.58)	2.67(0.76)	<b>P&lt;0.001*</b>	SS<SA,ER EA<SA
	Follow up	1.99(0.59)	2.98(0.66)	2.77(0.80)	2.06(0.74)	<b>P&lt;0.001*</b>	SS<SA,EA ER<SA,EA
	<b>Paired t- test</b>	<b>P=0.61</b>	<b>P=0.96</b>	<b>P=0.006*</b>	<b>P&lt;0.001*</b>		
BP	Baseline	2.13(0.62)	2.92(0.63)	2.26(0.76)	2.69(0.68)	<b>P&lt;0.001*</b>	SS<SA,ER EA<SA
	Follow up	2.14(0.47)	2.92(0.62)	2.41(0.66)	2.22(0.65)	<b>P&lt;0.001*</b>	SA>SS,EA,ER
	<b>Paired t- test</b>	<b>P=0.92</b>	<b>P=0.95</b>	<b>P=0.36</b>	<b>P=0.003*</b>		
CP	Baseline	3.26(0.61)	3.78(0.53)	3.31(0.57)	3.74(0.53)	<b>P&lt;0.001*</b>	SS<SA,ER EA<SA
	Follow up	3.20(0.64)	3.73(0.46)	3.34(0.57)	3.38(0.70)	<b>P=0.001*</b>	SS<SA
	<b>Paired t- test</b>	<b>P=0.58</b>	<b>P=0.36</b>	<b>P=0.85</b>	<b>P=0.003*</b>		

CP: cognitive processes, BP: behavioral processes, SE: self-efficacy

SS: stable sedentary, SA: stable active, EA: exercise adopters, ER: exercise relapsers

## Discussion

This study was conducted with the purpose of investigating transitional shifts in Physical Activity Behavior among employees of Birjand universities. Across the six months period of the study, no significant transitional shift occurred in the physical activity behavior of the participants where majority of them were in the stable active (39.1%) and stable sedentary (26.3%) groups. Marcus et al. study which was conducted on 314 employees utilized the same categorization; they reported that the majority of individuals belonged

to the stable active and stable sedentary groups, which is similar to the current study's findings <sup>[22]</sup>. In TTM, it is assumed that cognitive processes are used more at the early stages of change, while behavioral processes are applied more at the later stages. Self-efficiency and decisional balance increase along with progress in the stages of change <sup>[12]</sup>. Therefore, it can be expected that the mean scores of the model across the physical activity behavioral transitional patterns have significant differences. It is also expected that application of change processes as well as scores

of self-efficiency and decisional balance increase in exercise adopters and decreases in exercise relapsers, while no significant difference was expected in stable actives and stable sedentaries groups.

In the present study, exercise adopters had a significant increase in the mean score of pros and self-efficiency. Also, there was a significant decrease in the mean scores of behavioral processes, cognitive processes, and self-efficiency in the exercise relapsers which is in line with the presumptions of the model. Callaghan et al. showed that self-efficiency and pros increased among those who shift from the preparation to maintenance stages, however, it decreased among those who shifted from maintenance to action stages which is similar to finding of the present study <sup>[20]</sup>. Furthermore, in Barrett's study, there was a significant increase in the mean score of self-efficacy in the exercise adopters within 3 to 6 months from the onset of the study; this result is also similar to findings of the present study <sup>[21]</sup>.

In this study, processes of change did not increase among exercise adopters, a finding which is different from those of some other studies. For example, in Marcus et al.'s research there was a significant decrease in using processes of change in the relapsers <sup>[22]</sup>. In the current study, the stable actives had a significant decrease in their perceived benefits which contradicts the presumptions of the model.

In the present study, the perceived benefits, self-efficacy, and cognitive and behavioral processes had a significant difference in terms of transitional shifts patterns which confirms the presumptions of the model. The mean scores of perceived benefits, cognitive and behavioral processes, and self-efficacy were significantly

less in the stable sedentary group than in the stable active and relapsers groups; they were also less in the adopters than in the stable actives. In Levy et al.'s study the stable actives had a higher self-efficiency than the activity adopters, perpetual preparers, and stable sedentary/relapsers groups. Besides, exercise adopters had a higher self-efficiency than stable sedentary/relapsers groups; this is similar to findings of the present study <sup>[13]</sup>. In a study conducted by Cardinal et al., similar to the findings of the present study, higher scores of cognitive processes were reported for stable actives than adopters <sup>[18]</sup>.

In this research, there was only one participant who was at the action stage at both points of data collection. Thus, it might be safe to state that those who were in the preparation and maintenance stages at the onset and end of the study resided in the stable active group. Majority of the adopters were those who had shifted from contemplation stage to preparation stage, while the majority of relapsers were the ones who had shifted from the preparation stage to precontemplation and contemplation stages.

In TTM, the individuals who were in the precontemplation and contemplation stages performed similarly in behavioral aspects. Neither of the groups had physical activity with their mere difference lying in their intention to start physical activity. Individuals who were in the action and maintenance stages were also similar in behavioral aspects; they both had regular physical activity while the only difference was in the duration of their activity phase. However, individuals who were in the preparation stage had irregular physical activity and intended to regularize their physical activity within a month <sup>[17]</sup>. Therefore, it stands more reasonable to

categorize them under a separate category in a longitudinal study. Nonetheless, because of the limited number of participants this was not possible in the current study. In some other studies such as Prapavessis et al. the individuals who were in the preparation stage at the onset and end of the study were categorized under stable semi-active group<sup>[7]</sup>.

Another limitation of the current study lies within the method of self-report and reliance on the participants' memory for completion of the questionnaires which can lead to recall bias. Therefore, interpretation and generalization of the results require caution. Other longitudinal studies with wider sample sizes are suggested for both physical activity behaviors and other health behaviors.

## References

1. WHO. Health topics, physical activity. Available from: [http://www.who.int/topics/physical\\_activity/en/](http://www.who.int/topics/physical_activity/en/)
2. Esteghamati A, Khalilzadeh O, Rashidi A, et al. Physical Activity in Iran: Results of the Third National Surveillance of Risk Factors of Non-Communicable Diseases (SuRFNCD-2007). *Journal of Physical Activity and Health*. 2011;8:27-35.
3. Nikpour S, Rahimiha F, Haghani H. Comparing the Status of Sport Activities in Women and Men Working at Iran University of Medical Sciences and Health Services. *Journal of Iran University of Medical Sciences*. 2006;13(52):205-16. [persian]
4. Jalilian F, Emdadi S, Mirzaie M, et al. The Survey Physical Activity Status of Employed Women in Hamadan University of Medical Sciences: The Relationship Between the Benefits, Barriers, Self- Efficacy and Stages of Change. *Toloo e Behdasht*. 2011;9(4):89-98. [persian]
5. Jalilian M, Darabi M, Sharifirad GH, et al. Interventional Program based on Trans-Theoretical Model to Promote Regular Physical Activity in Office Workers. *Journal of Health System Research*. 2013;9(2):188-95. [persian]
6. Prochaska JO, Evers KE, Castle PH, et al. Enhancing multiple domains of well-being by decreasing multiple health risk behaviors: a randomized clinical trial. *Population Health Management*. 2012;15(5):276-86.
7. Prapavessis H, Maddison R, Brading F. Understanding exercise behavior among New Zealand adolescents: a test of the transtheoretical. *Journal of Adolescent Health*. 2004;35(4):346 e17-27.
8. Plotnikoff RC, Hotz SB, Birkett NJ, et al. Exercise and the transtheoretical model: a longitudinal test of a population sample. *Preventive Medicine*. 2001;33(5):441-52.
9. Plotnikoff RC, Lippke S, Johnson ST, et al. Physical activity and stages of change: a longitudinal test in types 1 and 2 diabetes samples. *Annals of Behavioral Medicine*. 2010 Oct;40(2):138-49.
10. Moeini B, Jalilian M, Hazavehei SM, et al. Promoting Physical Activity in Type 2 Diabetic Patients: A Theory-Based Intervention. *Health System Research*. 2012;8(5):824-33. [persian]

## Conclusion

The results of this study provided relative support for the internal validity of TTM. It seems that the perceived benefits, cognitive and behavioral processes of change, and self-efficacy are better predictors of transitional stages of change from the onset to the end of the study. Therefore, given the role of these constructs in adopting and maintaining physical exercise behavior, the interventions based on TTM can be effective.

## Acknowledgement

This article is the product of a research project approved by Birjand University of Medical Sciences. Special thanks go to the authorities and employees of all the universities in Birjand for their cooperation in this project.



11. DiClemente CC, Nidecker M, Bellack AS. Motivation and the stages of change among individuals with severe mental illness and substance abuse disorders. *Journal of Substance Abuse Treatment*. 2008;34:25-35.
12. Schumann A, Kohlmann T, Rumpf HJ, et al. Longitudinal relationships among transtheoretical model constructs for smokers in the precontemplation and contemplation stages of change. *Annals of Behavioral Medicine*. 2005;30(1):12-20.
13. Levy SS, Li KK, Cardinal BJ, et al. Transitional shifts in exercise behavior among women with multiple sclerosis. *Disabil Health Journal*. 2009;2(4):216-23.
14. Shafakhah M, Moattari M, Sabet Sarvestani R. Assessing Stages of Exercise Behavior Change, Self Efficacy and Decisional Balance in Iranian Nursing and Midwifery Students. *World Academy of Science, Engineering and Technology*. 2013 (73):1034-9.
15. Castle PH. Transtheoretical model relationships across multiple health behaviors: A longitudinal analysis [Ph.D]. Ann Arbor: University of Rhode Island; 2011.
16. Jordan PJ, Nigg CR, Norman GJ, et al. Does the transtheoretical model need an attitude adjustment?: Integrating attitude with decisional balance as predictors of stage of change for exercise. *Psychology of Sport and Exercise*. 2002;3(1):65-83.
17. Armitage C. Can variables from the transtheoretical model predict dietary change? *Journal of Behavioral Medicine*. 2010;33(4):264-73.
18. Cardinal BJ, Lee JY, Kim YH. Predictors of Transitional Shifts in College Students' Physical Activity Behavior. *International Journal of Applied Sports Sciences*. 2010;22(1):24-32.
19. Nigg CR. Explaining adolescent exercise behavior change: a longitudinal application of the transtheoretical model. *Annals of Behavioral Medicine*. 2001;23(1):11-20.
20. Callaghan P, Khalil E, Morres I. A prospective evaluation of the Transtheoretical Model of Change applied to exercise in young people. *International journal of nursing studies*. 2010;47(1):3-12.
21. Barrett BS. An application of the transtheoretical model to physical activity: ProQuest Information & Learning; 1998.
22. Marcus BH, Simkin LR, Rossi JS, et al. Longitudinal shifts in employees' stages and processes of exercise behavior change. *American Journal of Health Promotion*. 1996;10(3):195-200.
23. Marcus BH, Selby VC, Niaura RS, et al. Self-Efficacy and Stage of Exercise Behavior Change. *Research Quarterly for Exercise and Sport*. 1992;63(1):60-6.