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## **USING CONSTRUCT OF THE TRANS -THEORETICAL MODEL TO PHYSICAL ACTIVITY BEHAVIOR IN OSTEOPOROSIS PREVENTION: A THEORY-BASED STUDY**

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### **ABSTRACT**

#### **Introduction**

Regular physical activity has positive effects on physical, mental and social status of individual especially osteoporosis prevention. Health policy makers have planned to encourage people to do the most physical activity. The trans-theoretical model is identified as a comprehensive model for physical activity behavior. Therefore, this study aimed to determine using a trans-theoretical model to physical activity behavior in osteoporosis prevention.

#### **Material and Method**

In a cross-sectional study, this studies 269 women who were selected from all the health centers of Khorramabad according to the inclusion criteria of the study and through two-stage cluster and systematic sampling method. The tools for data collection were valid and reliable questionnaires of demographic variables and construct of the Trans theoretical model of stages of change and physical activity. The data was analyzed using SPSS software.

#### **Results**

The mean age of the subjects was  $38.72 \pm 7.003$ , and the mean light weekly physical activity was  $38.83 \pm 56.400$ . The results showed that 43.5% of the women were in the pre-contemplation stage and 9.4% in the maintenance stage in doing regular exercise. Also, in terms of the ranking of stages of change in physical activity, 82.9% were in the non-action phase and 17.1% in the action phase. The results also showed that the construct of self-efficacy had the highest predictive power for the preventive behavior.

#### **Discussion**

The results showed that self-efficacy among the constructs of the Trans theoretical Model was the only predictive construct for regular physical activity osteoporosis prevention behavior. Therefore, the findings of this study can serve as a base for educational interventions in behavioral changes for the prevention of osteoporosis by health authorities.

**Keywords:** *Trans Theoretical Model, Physical Activity Behavior, Osteoporosis Prevention, Women*

### **INTRODUCTION**

Osteoporosis is the most common type of metabolic bone disease in which bone mass reduces with aging. This disease is known as an important health priority in community public health, particularly in women (Hazavehei *et al.*, 2007; Tussing & Chapman-Novakofski, 2005). The disease remains asymptomatic until bone fracture, and therefore it is also called the “silent thief” (Chan *et al.*, 2007). The prevalence of osteoporosis varies among countries and even within countries (Hazavehei *et al.*, 2007). Previous studies have shown that the prevalence of osteoporosis in Iran is mostly at the age of 50 and over, 22.2% of females, and 11% in males (Adib & Nauroy, 2011; Salehi *et al.*, 2009). A fracture due to osteoporosis happens every 3 seconds, and a fracture of the spine occurs every 22 seconds worldwide (PDO, 2006). One out of two women over 50 experiences vertebral fractures, and one out of three men over 50 experiences hip fractures in their lifetime, and both of these conditions lead to significant morbidity and

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mortality (PDO, 2006; Schwellnus *et al.*, 2011). According to global statistics, our country Iran, like other countries, will have a considerable population of the elderly in the next 50 years, so that 14% of the population (11 million people) are 50 and over and 3.6% (2.6 million people) 70 and over, and around 34% of the population (42 million people) will be 50 and over by 2050 (Adib & Nauroy, 2011). The costs of the disease will be enormous (Khorsandi *et al.*, 2011; Moayyeri *et al.*, 2006) so that the medical cost of osteoporosis-related fractures has been more than 22 billion dollars in the USA (Blume & Curtis, 2011). If effective preventive measures are not consistently promoted, it is predicted that the cost of osteoporosis in the world will rise to 200 billion dollars before the year 2040 (Blume & Curtis, 2011). Preventing osteoporosis and its subsequent fractures is the objective of many healthcare professionals (Tussing & Chapman-Novakofski, 2005). According to research, obtaining a high bone density and maintaining it during lifetime play a significant role in preventing osteoporosis in old age (Heaney & Weaver, 2003). Studies have shown that physical activity plays a critical part in the prevention of osteoporosis (Lowe *et al.*, 2011; Sharma *et al.*, 2010; Khawaji *et al.*, 2010; Khorsandi *et al.*, 2011). Regular physical activity can have a positive effect on bone mass during lifetime (Alev & Yurtkuran, 2003). Physical activity has gained a particular place in the context of medicine as a therapeutic tool (DWS, 2005). Therefore, physical activity, particularly if it is accompanied by weight bearing, results in maintaining and even increasing bone mass through exerting mechanical pressure on bones (Maimoun *et al.*, 2005; Habibzadeh *et al.*, 2009; Ebrahim *et al.*, 2010). Moreover, since behavior change is the basis and foundation of preventing many health-associated risks (Rollnick *et al.*, 2007). Regular physical activity has been recommended as an effective way for the prevention of osteoporosis (Karimzadeh *et al.*, 2007; Glanz *et al.*, 2008). Experts believe that the effectiveness of health education and behavior change programs depend mainly on the use of models and theories of health literacy (Butler, 2001; Araban *et al.*, 2013). Choose a model health education is the first step in health education program (Glans *et al.*, 2008). On the other hand, since the prevention of behavioral factors influencing osteoporosis requires individuals' behavioral change (Glanz *et al.*, 2008; Araban *et al.*, 2013), the models and theories of health education and health promotion can be useful in designing interventions in this field at three levels of prevention (Parker *et al.*, 2004; Araban *et al.*, 2013). A health education model that can be used to change behavior at an individual level is the Trans- theoretical model (Prochaska *et al.*, 1992; Prochaska & Marcuse, 1994). The model has been used for a range of health behaviors since its introduction (Araban *et al.*, 2013; Salehi *et al.*, 2010; De *et al.*, 2007; Schüz *et al.*, 2009; De *et al.*, 2008; Marcus *et al.*, 1994; Prochaska & DiClement, 1983; Lawrence *et al.*, 2005), and can predict the way and time of behavioral change (Sharma & Romans, 2008).

The model has four constructs of “stages of change”, “process of change”, “self-efficacy”, and “decisional balance” (Velicer *et al.*, 2001). The construct of “stages of change” has been recognized as a comprehensive model in behavior change. This model focuses on an individual's preparation or effort to change and progress towards healthy behaviors. The importance of the model is that it shows the occurrence of change in the five stages (Parker *et al.*, 2004) and suggests that people need different interventions at any stage (Figure 1). The first stage is "pre-contemplation" in which the individual does not think about behavior change within 6 months. Two groups of people fall in this stage: first, people who are unaware or have little information, these people are not aware of the consequences of behavior; second, those who have experienced change but have failed in the past, these people are resistant to change. The second stage is "contemplation" in which the individual thinks about behavior change in the future (within 6 months). People in this stage will weigh the benefits (pros) and the costs (cons) of behavior change and hence stay longer in this stage. The third stage is “preparation” in which the individual thinks about plans for behavior change in the near future and usually the next month. People in this stage have some plans for change and have taken actions. The next stage is “action” in which the individual has changed behavior within the last 6 months, and new behaviors can clearly be observed in this stage. The last stage is “maintenance” in which the individual has taken actions to maintain behavior change for a long time (6 months or more) (Glans, *et al.*, 2008). People in each stage require different interventions, and this categorization will enable us to intervene with regard to the stages.

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“Processes of change” is another construct which shows how a behavior changes in each of the stages. The processes of change include activities and strategies that will help the individual to progress in the stages, and include two main types of cognitive processes (related to the individual’s thoughts and feelings about unhealthy behavior) and behavioral processes (causing changes in unhealthy behavior). The application of these processes results in strengthening the individual in adopting the new behavior and maintaining the behavior (Lee, 2004).

The third construct of the model is “decisional balance”, which is defined as the benefits (pros) and costs (cons) of behavior change from the individual’s view (Prochaska & Velicer 1997; Yalcinkaya-Alkar & Karanci 2007. According to this model, change occurs when the benefits are greater than the costs. This type is particularly important in the pre-contemplation and contemplation stages (Yasin, *et al.*, 2011) (Yasin, *et al.*, 2011; Prochaska *et al.*, 2008), and the benefits and costs are similar to those in the health belief model (Prochaska & Veiver 1997).

The fourth construct of the model is “self-efficacy”, which refers to the individual’s perceived confidence in the ability to perform a particular behavior successfully. The construct has been adopted from Bandura’s social learning theory and Shiffman’s model of consistency and relapse (Bandura, 1997 & Bandura, 2006; Bandura, 1982).

This construct is unique to the relevant behavior and has a pivotal role in changing behavior and moving toward higher stages of change. It also has a direct linear correlation with the stages of change. In this regard, some strategies have been recommended to enhance self-efficacy such as breaking the behavior into small, simple, and practical steps, taking advantage of persuasion, reducing stress, and using believable role patterns (Sharma & Romans, 2008).

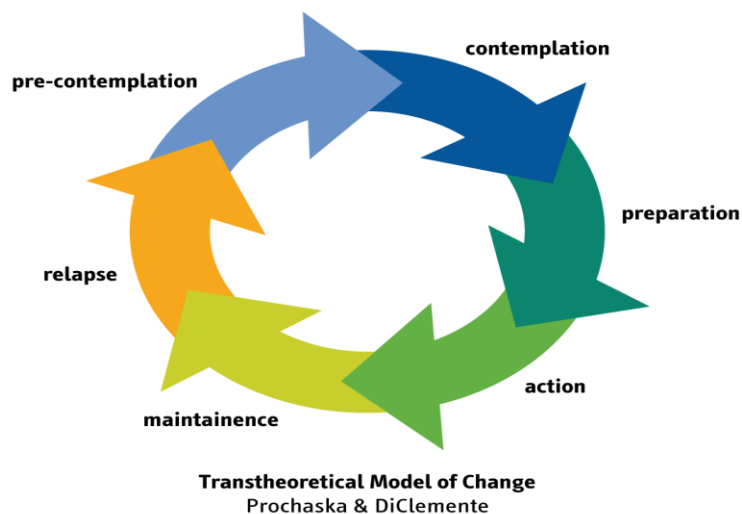


Figure 1: Stages of change in the TTM

This construct has a central role in changing behavior and entering the higher stages of behavioral change (Prochaska *et al.*, 2008). Finally, the model usually interprets behavior change as an event and evaluates overt behaviors at the end points.

In order to modify osteoporosis prevention behaviors such as regular physical activity that requires behavioral continuity unlike simpler and one-step behaviors, it is logical to apply those models that are sensitive to different stages and small steps of change (Araban *et al.*, 2013). Therefore, the present study aimed to determine using the trans-theoretical model to physical activity behavior in osteoporosis prevention in women aged 30-50 years in the city of Khorramabad (west of Iran). It is hoped that theory-based interventions are designed through identifying the factors influencing the behavior to take an important step in improving women's health.

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### **MATERIALS AND METHODS**

#### **Method**

This descriptive-inferential cross-sectional study included 269 women aged 30-50 years old admitted to the health care centers of Khorramabad, west of Iran in 2013. The sample size was determined based on the number of the constructs of the Trans-theoretical Model. Therefore, 50 samples were chosen for each construct, and 7% was added (Hajizadeh & Asghari, 2011). Sampling was performed through the multi-stage cluster sampling. The city was divided into four areas of north, south, east, and west. Then, one health care center was chosen randomly from each sector, and the samples were selected randomly from the individuals admitted to the health care centers considering the inclusion criteria of the study. The inclusion criteria of the study were as follows: females aged 30-50 years old with at least a fifth-grade primary school educational level, lack of rheumatoid disease and mental illness, lack of fractures, pregnancy, menopause and breast-feeding, and consent to participate in the study. Before entering the study, the participants were provided with the necessary information about the study, and those who showed their willingness to participate through verbal consent were included in the study. The study was approved by the ethics committees of Tarbiat Modares University and Lorestan University of Medical Sciences. To collect the data ATTo collect the demographic information, a questionnaire of demographic information was applied, which included age, educational level, marital status, number of children, housework, menstrual age and abnormality, income, height and weight, and tea as well as supplements consumption.

The stages of change in physical activity were measured using the 5-point Stages of Exercise Change Questionnaire (SECQ) prepared by Marcus *et al.*, (1992). The questionnaire was applied to its content validity index ( $>0.7$ ), content validity ratio (0.59) and face validity (IF=5) were approved. The survey put individuals in the stages of Pre-contemplation (not thinking about behavioral change in osteoporosis prevention in the next 6 months), contemplation (thinking about behavioral change in osteoporosis prevention in the next 6 months), preparation (thinking about behavioral change in osteoporosis prevention in the next month), action (taking action to change in osteoporosis prevention in the previous day to 6 months), and maintenance (sustaining action in osteoporosis prevention for more than 6 months) (Sharma & Romans, 2008). Since the questionnaire was dynamic in nature, it had one question at five levels. Therefore, the standard methods for determining reliability were not appropriate for the questionnaire (Araban *et al.*, 2013). However, since the process of validity confirmation was performed carefully, we can say that the questionnaire had the necessary reliability and validity. The poll put the individuals in one of the five stages. Therefore, a score of 1 to 5 was assigned to each phase. The preventive behavior in this study was defined as physical activity at least five days a week and for 30 minutes each time.

The questionnaire by Nigg *et al.*, (1998) was applied to determine decisional balance (pros and cons), and Schwarzer and Renner's 5-point Health-specific Self-efficacy Scale to measure individuals' confidence in overcoming the current cons in doing regular physical activity. It should be noted that in this study one question was added by the researchers to the self-efficacy scale, and the decisional balance (pros and cons) scale included 11 questions for each variable equally (Karimzadeh *et al.*, 2007). Each item was scored based on a 5-point Likert scale ranging from 1 (crucial) to 5 (completely unimportant). The total scores of the questionnaire for the constructs of pros and cons in decisional balance did not range from 11 to 55. The content validity for the pros (CVI=0.99, CVR=0.8), the content validity for the cons (CVI=0.88, CVR=0.70), and the face validity (IF=1.5) were approved. The reliability of these two questionnaires was adopted with a Cronbach's alpha of 0.88.0/88 the self-efficacy questionnaire included six questions and was prepared based on the theory of Bandura's self-efficacy. The content validity (CVI=0.94, CVR=0.71), the face validity (IF=1.5), and the reliability of the questionnaire (Cronbach's alpha=0.82) were approved. The answers of this tool were on a Likert scale ("I'm entirely sure" to "I'm not sure") with a range of 6 to 24 scores.

The tool for assessing physical activity was the International Physical Activity Questionnaire 3. This tool records information on the amount of time spent by a person to walk (for exercising) and to do moderate

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or high physical activity in the past seven days. The tool was prepared by a group of international experts in 1998 in Geneva, has been so far applied in numerous studies, and its reliability and validity have been reported (Craig *et al.*, 2003). The data were collected from the samples in one step and were analyzed with SPSS 16 using descriptive and inferential statistics (chi-square test, Spearman and Mann-Whitney correlation coefficients). Logistic regression was performed to evaluate the predictive power of the model constructs in adopting the behaviors of osteoporosis prevention, so that the individuals in the stages of "pre-contemplation", "contemplation" and "preparation" were put in the "non-action" group (those without healthy behaviors), and those in the "action" and "maintenance" stages were included in the "action" group (those with healthy habits). The data were analyzed considering the significance level of 0.05.

## RESULTS AND DISCUSSION

### Results

The results showed the highest frequency (41%) for the age group of 30-35, the lowest (17.8%) for the age group of 45-50, and the mean age of  $38.72 \pm 7.003$ . Moreover, 36.8% had high school diplomas, and 26% had academic degrees. With respect to marital status, 75.1% of the subjects were married. Regarding occupation, 75.1% were housewives, the rest were employed, and 73.1% of the employed subjects were working in state organizations. Concerning income, low income (less than 500,000 tomans monthly=170 USD) with 46.5% and good income (more than 900,000 tomans monthly=300 USD) with 20.4% had the highest and lowest frequencies respectively. The mean age of menarche was  $13.84 \pm 1.9$ , with the lowest menarche age of 9 (0.4%) and the highest of 21. Also, the highest frequencies were found for the age of 14 (33.1%) and 13 (21.2%). Also, 11% of the subjects had experienced 1-5 miscarriages. Concerning number of children, 29.4% had two children. In terms of physical activity and housework, 7.8% of the subjects did not do housework, 33.8% did housework for three other individuals, and 22.7% for four other people.

The results also showed that 76.6% of the women had no menstrual abnormalities, and only 23.4% had menstrual irregularities out of whom 59 (21.9%) had the abnormality of irregularity. The mean and standard deviation of light weekly physical activity was  $38.83 \pm 56.400$  minutes, and the mean and standard deviation of the moderate weekly exercise was  $4.77 \pm 29.119$  minutes. The results of the construct of "stages of change" related to physical activity in the women showed that 43.5% of the women were in the pre-contemplation stage and 9.4% in the maintenance stage in doing regular physical activity, as shown in Table 1. Also, in terms of the ranking of stages of change in physical activity, 82.9% were in the non-action phase and 17.1% in the action phase (Table 2). Table 1 shows the results of the constructs of stages of change related to physical activity in the women. Logistic regression was applied to determine the predictors of physical activity behavior (Table 3).

Results of the Mann-Whitney test showed a significant relationship between the constructs of stages of change and income ( $p < 0.006$ ). Also, the results of Pearson test showed a statistically significant association between the constructs of stages of change with educational level ( $p < 0.043$ ) and occupation ( $p < 0.014$ ).

**Table 1: Frequency distribution of the stages of change related to the variable of physical activity in the studied women**

Stages of change	Physical Activity	
	Frequency	Percentage
Pre-contemplation	117	43.5
Contemplation	50	18.6
Preparation	56	20.8
Action	20	7.4
Maintenance	26	9.4

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**Table 2: Frequency distribution of the stages of change related to the variable of physical activity in the studied women based on action and non-action**

Ranking of the stages of change	Physical Activity	
	Frequency	Percentage
Non-action	223	82.9
Action	46	17.1

**Table 3: Predictive variables of stages of change related to physical activity behavior based on the Trans-theoretical model constructs**

Variable	Confidence interval		Odds ratio	P-value
	Upper	Lower		
Income	1.000	1.000	1	0.347
Educational level	2.046	0.971	1.409	0.071
Self-efficacy of physical activity	1.264	1.083	1.170	0.000
Pros of physical activity	1.025	0.933	1.046	0.123
Cons of physical Coactivity	1.109	0.988	0.978	0.358
Occupation	3.482	0.55	1.384	0.490

**Discussion**

Regular physical activities, fitness and sport are of special significance for people's health and feeling well in all ages and decrease in physical activity is one of the problems of urbanization and industrial development that has a dominate role in the non- communicable of diseases, morbidity and mortality. According to the findings of some studies, one of the important elements in the prevention of osteoporosis is regular physical activity (Bjugstad K; 2012). Regular physical activities, fitness and sport are of special significance for people's health and feeling well in all ages. This study showed that a large number of women were in the non-action stage (precontemplation, contemplation and preparation). These findings are consistent with Shafakhah *et al.*, study's (2013) and Irwin *et al.*, study's (2004) (Shafakhah *et al.*, 2013, Irwin, 2004).

The findings showed that only the construct of “self-efficacy” among the constructs of the Trans-theoretical Model had the predictive power for the behavior. The results of a comprehensive study by Schwarzer *et al.*, indicated that self-efficacy could have a higher predictive power in health behaviors than the other constructs (Schwarzer & Fuchs, 1996). The results of Berry *et al.*, and Kim’s studies on exercise behavior, Swaim's study on the relationship between physical activity self-efficacy and physical activity behavior, and Dishman’s *et al.*, study reported self-efficacy as the most important predictor of the behavior (Kim, 2004; Berry *et al.*, 2005; Swaim *et al.*, 2008; Gammage *et al.*, 2009; Dishman *et al.*, 2010; Khave *et al.*, 2014). It seems that adopting preventive behaviors for osteoporosis is also more dependent on self-efficacy. Bandura, as the developer of the theory of self-efficacy, believes that self-efficacy is specific to a specific behavior. A person may have high self-efficacy in one behavior and low self-efficacy in another one (Sharma & Romans, 2008; Bandura, 1977; Kim, 2004; Berry *et al.*, 2005; Swaim *et al.*, 2008; Gammage *et al.*, 2009). Bandura comprehensive a mentions four factors of success in performance, succession experiences, verbal encouragement, and physiological and emotional arousal as the sources of self-efficacy (Bandura, 2006). Therefore, self-efficacy is an important component of success, which falls in the field of positive psychology (Snyder & Lopez, 2002). The construct of self-efficacy, or belief in “I can”, refers to a person's ability to perform tasks in certain circumstances. Additionally, another type of self-efficacy refers to the person's overall belief about his or her own abilities and capabilities (Mazloumi *et al.*, 2010).

Based on the results of our study, 79.9% of the women were in the no-action stage (pre-contemplation, contemplation, and preparation), and 20.1% were in the action stage (action and maintenance) through adopting regular physical activity. Also, most of the women (41.3%) were in the pre-contemplation stage

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and the lowest number (6.7%) in the action stage, while in Nigg *et al.*'s study most of the subjects (49.3%) were in the maintenance, the lowest number (2.1%) in the pre-contemplation stage, and 3.8% in the action stage (Nigg & Courneya, 1993). In Mazloumi *et al.*'s study in 2010, 20% of the subjects were in the pre-contemplation stage, 40% in the contemplation stage, 13.6% in the preparation stage, 7.3% in the action stage, and 19% in the maintenance stage (Mazloumi *et al.*, 2010). Therefore, regular physical activity according to regular and specific patterns should be part of an overall strategy to prevent osteoporosis in women so that an individual can change behavior intentionally (DiClemente, 2005). The results of our study did not show significant differences in the scores of the constructs in terms of marital status. However, Tol *et al.*'s study indicated that self-efficacy was associated with marital status (Tol *et al.*, 2012). This contrast might be justified according to cultural and social contexts of the studies. Married people spend most of their time on daily life activities, and, therefore, spend less time on regular physical activity because of the higher responsibilities they have compared to the other members of their families. However, this interpretation is not always correct.. Investigating the relationship between the constructs of the Trans-theoretical Model and regular physical activity revealed that the studied women used more cognitive and behavioral processes in order to adopt physical activity behavior and possessed higher self-efficacy in physical activity when they were in higher stages of change. Based on the Trans-theoretical Model, individuals can go through the stages of change by gaining experience and skills. Returning to previous stages may even happen, which is justifiable considering the circular nature of the model. The results of our study on decisional balance showed that the central components of pros and cons in this construct are very important in making decisions on physical activity. The results showed that the individuals in the pre-contemplation stage had negative comments on physical activity such as being time-consuming and tedious (cons), while the women in the maintenance stage had positive comments on physical activity (pros) (Omar-Fauzee *et al.*, 2009; Moeini *et al.*, 2011).

The results showed no significant relationship between the construct of decisional balance and physical activity. This result is consistent with the results of Moeini *et al.*, and Araban *et al.*'s studies, but inconsistent with the studies conducted by Kidd *et al.*, and Omar-Fauzee *et al.*, (Omar-Fauzee *et al.*, 2009; Kidd & Peters, 2010; Moeini *et al.*, 2011; Araban *et al.*, 2013). Therefore, these results suggest that the construct did not have the power to predict the behavior of physical activity. This predictive inability of the pros and cons constructs can be attributed to the high points of these two constructs in the studied population in our study. Therefore, as it is emphasized by Pawlak *et al.*, (Pawlak & Colby, 2009), high scores of pros and low scores of cons cannot predict health behaviors. It is also possible that adopting preventive behaviors (physical activity) for osteoporosis is more dependent on self-efficacy.

The results of the present study showed that, among the constructs the Trans-theoretical Model, self-efficacy is the only construct that can predict the adoption of osteoporosis prevention behavior. Therefore, it is recommended that more extensive studies be conducted to confirm our finding. The study did not use the construct of processes of change due to the probable numerous items in the questionnaire in two behaviors of physical activity and calcium intake, and answering the questions took a long time, and these were the limitations of the study. This study is among the first studies carried out on behavior change to prevent osteoporosis in women aged 30-50 in Khorramabad based on the patterns of health education and enhancement.

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