# Determinants of physical activity to prevent falls in older people: an investigation based on the protection motivation theory

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# Abstract

Background Physical activity (PA) is important for preventing falls in older age. However, most older people in Iran have not been involved in any exercise program. The aim of this study was to assess the determinants of physical activity to prevent falls using protection motivation theory (PMT) in Iranian older people.

Methods The cross-sectional study was conducted in Qom, Iran, from May to October 2018. Three hundred older people were selected from retirement centers via stratified sampling method. Data was collected using the Rapid Assessment of Physical Activity, and PMT constructs scale. Data analysis was performed using multiple linear regression and descriptive statistical analysis.

Results The mean (SD) age of the participants was 64.6 (5.5) and the majority were male (77.7%). Level of perceived self-efficacy of participation was low. Perceived costs and perceived rewards were negatively associated with motivation. Furthermore, protection motivation ($\beta$=0.38, P<0.0001), fear ($\beta$=0.21, P=0.001), and efficiency of response ($\beta$=0.13, P=0.026), significantly predict PA behavior. The study model explained approximately 32% of the variance in PA behavior.

Conclusion The results indicated that reducing barriers to exercising might increase PA intention. Also, protection motivation and efficiency of response and fear are considered as the strongest predictors of PA behavior among older people. The results can help health care providers to develop appropriate interventions for promoting PA among older people.

# Introduction

In recent years, the proportion of older has grown all over the world. According to the World Health Organization (WHO) latest report, between 2015 and 2050, the proportion of the older people will increase from 12 to 22 percent, from 900 million to 2 billion [1]. In Iran, the population over 60 years old by 2020 will be about 10 million, and by 2050, it will reach over 26 million. As age increases, the risk of chronic diseases increases, so that most people over 60 have at least one chronic illness [2]. Physiological changes that occur during aging include specific changes in the nervous and musculoskeletal system, which can increase the risk of falls [3]. Falls are the major cause of death related to injuries, leading to fear of falling, and lower quality of life in older people [4].

As an important health promotion for older people, regular physical activity (PA) has been demonstrated to improve chronic diseases and prevent early mortality, and its importance as a strategy for preventing of falls and their consequences in older people has been addressed through many studies [5–7]. The suggested target for older people is 150 minutes a week of moderate intensity activity in bouts of 10 minutes or more [8]. However, a recent report from the National Center for Health Statistics states that in the United States more than 1 in 4 adults over 50 do not engage in regular PA and only 12.7% of older people have a regular exercise program [9]. In Iran, findings from a study show that 13.7 % of older people in Iran are physically active [10].

It seems that among older people, many barriers such as low levels of motivation and/or fear of falling can be considered as a barrier to PA, while at the same time, PA is considered to be a major factor in successful aging [11, 12]. The guiding framework is derived from health behavior theories can help to understanding effective factors of PA behavior to develop effective health promotion programs. Protection motivation theory (PMT) [13] is a theory to assess fear in order to predict and encourage people to do protective behaviors. Base on PMT, it is assumed that acceptance of recommended protective behavior against a health risk is a direct action of the individual's motivation to protect him/herself. Two cognitive mediation processes of threat appraisal and coping appraisal determine the intent of individuals for protective behaviors. Threat appraisal component includes (1) perceived severity (a person's belief in the danger being serious), (2) perceived vulnerability (a person's belief in being vulnerable to a health hazard), and intrinsic and extrinsic rewards (the person´s belief on positive aspects of her/his unhealthy behavior). In addition, coping appraisal includes (1) the response efficacy (A person's expectation that a protective behavior can eliminate the risk), (2) self-efficacy (a person's belief in being able to successfully do the protective behavior), and the response cost (a person's estimate of any cost such as money, time, effort that is related to the conduct of a protective behavior). 'Response-efficacy' and 'self-efficacy' are expected to promote motivation to engage in health-promoting behavior, whereas 'response costs' and rewards are expected to reduce it [14, 15].

Previous studies have shown that PMT may be a good predictor of protective behaviors, like smoking/tobacco use [16, 17], cancer preventive behaviors [18, 19], cancer screening [20, 21], and sexual behaviors [22, 23] PA behavior [24]. Theory-based studies on PA behavior are important for designing effective intervention programs. However, to the best of our knowledge, no similar study has been conducted among Iranian older people. This study was conducted with the aim of identifying determinants of PA intent and behavior to prevent falls in Iranian older people.

# Method

## Design, setting and participants

This cross-sectional study was conducted in 2018 in Qom, a city in the central region of Iran with a population of approx 1.2 million people. There are several retirement centers with different social and occupational backgrounds in Qom. The centers are affiliated to the national pension organization offering free services to old people who are members. The percentage of older people members in each center relative to the total number of older people members of the retirement centers was determined. Then, by percentage, the samples were randomly assigned to participate in the research, using a stratified sampling method. The inclusion criteria included people aged 60 years or older, with and without the history of the falls, members of Qom's retirement centers, independently living at home, lack of psychological and cognitive impairment (score 6 or higher in the Persian version of the abbreviated mental test [25], consent to participate in the study, ability to communicate and respond. The exclusion criterion was as follows: refusal for participation in study.

After ethical approval for research from the Hamadan University of Medical Sciences (registration number: IR.UMSHA.REC.1396.911) and coordinating with the authorities of the retirement centers was obtained, the participants were asked to participate in the study, according to the criteria. Participants were well informed on the purpose of the study, the confidentiality of the information, and the purpose of the project. In all, 340 older people were approached. Thirty-two persons withdrew from the study due to not completing questionnaires. Eight persons did not meet the identified inclusion criteria. Therefore, 300 individuals aged 60–88 years completed the study (response rate, 90%). Most participants were males (77.7%), married (88.7%), and had low literacy (58.6%). 21% of participants had a history of falls in the past six months. The demographic characteristics of participants are presented in Table 1.

TABLE 1

*Data collection*

The purpose of the study and the data collection procedure was explained to the participants. They were assured about confidentiality of the information to be provided. The data collection was performed by principal researcher (ZTK) and a trained interviewer at centers over a period of 6 months. The assessment of each participant took about 20 minutes.

*Measurements*

*Physical activity* was assessed using the Rapid Assessment of Physical Activity (RAPA). RAPA is a self-reporting tool developed by Topolski et al. [26] The scale consists of nine items with two-response option (yes or no) and measures different levels (sedentary to regular active) of PA over the past week. The total score is based on the highest associated score (i.e., intensity of PA from 1 to 7). In addition, an affirmative answer for participating in muscle strengthening activities such as lifting weights or calisthenics, adds another point. The older people who participated in flexibility activities such as stretching or yoga, were awarded two bonus points, leading to a total possible score of 10 points. So, higher scores represent a better level of health-promoting PA. Previous evaluations of RAPA indicated good reliability and validity [26–28].

*PMT constructs for PA behavior* was assessed using aPMT scale include 8 sub-scales and 24 items. To prepare the scale, we first determined content domain of a construct using the literature review and developed it base on framework of the theory [12]. Perceived vulnerability with 3 items, e.g., "May I also fall." Perceived severity with three items, e.g., "fall makes me depend on someone else to do the routine". The efficiency of response, e.g., "falls can be prevented by increasing daily physical activity". The perceived self-efficacy with 2 items e.g., "I cannot do exercise due to loss of physical power". The response cost with 3 items, e.g., 'I do not do physical activity, because I do not have enough time'. Fear with 3 items, e.g., "thinking of fall makes me scared". The perceived reward with 2 items, e.g., "not doing regular physical activity is nice for me", and protection motivation with 2 items, e.g., "I decide to allocate some time doing regular physical activity". The responses were marked using a 5-point Likert scale from completely agree (1) to completely disagree (5). Each item was scored from 1 to 5. The score of each

subscale was obtained by computing the sum of the items of it. Content Validity Ratio (CVR) and Content Validity Index (CVI) were used to determine the content validity. Overall, the items reached CVI and CVR above 0.90, meaning a good content validity of the scale. The Cronbach's alpha ranged from 0.70 to 0.90 and the test-retest reliability ranged from 0.78 to 0.90, indicating an acceptable result.

*Demographic characteristics* included gender, educational level, marital status, economic status, body mass index (BMI), co-morbidity (have one or more chronic illnesses), history of falls in the past 6 months.

*Data analysis*

Data were analyzed with SPSS software, version 20.0. Descriptive statistics were used to summarize the sample characteristics. Pearson correlation coefficients were computed to assess the relationship between PMT constructs and PA behavior. Moreover, multiple linear regression analysis with the Enter method was applied to illustrate the variations in PA behavior and Protection Motivation scores based on PMT constructs. Regarding the theoretical framework of this study, protective motivation theory constructs as independent variables and protective motivation and physical activity as a dependent variable were included in the regression analysis simultaneously. The confidence level was also 95%.

# Results

*PMT constructs and PA behavior*

Table 2 shows the means and standard deviations of PMT constructs and its correlations with PA behavior. The findings showed that 69 (23%) were at inactive level, 76 (23.3%) at the low activity level, 36 (12%) had regular light activities, 41 (13.7%) were regular underactive and 78 (26%) regular active. Participants rated response cost (25.2%), fear (33.3%) and self-efficacy (41.1%) as the lowest percentage. Response efficacy (73.3%), severity (66.6%), and rewards (51.2%) were the highest percentages of the mean from the maximum obtainable score. PA behavior was significantly associated with all of PMT constructs except vulnerability and self-efficacy.

TABLE 2

*Prediction of PA intent and behavior*

The result of regression analysis of constructs of the PMT model in predicting the PA behavior, using the Enter method, showed that three constructs of protection motivation (β = 0.38, P < 0.0001), fear (β = 0.21, P = 0.001) and efficiency of response (β = 0.13, P = 0.026) significantly predict PA behavior. The overall R Square was 0.33; the model can explain one-third of the variability in the data. By increasing a unit of standard deviation in the protection motivation score, the physical activity scores will increase by 0.94 standard deviations. Also, with an increase in a standard deviation in the response efficiency score, the physical activity score will be higher than 0.24 standard deviation, and if the standard deviation increases in the fear score, the physical activity score will decrease 0.17 standard deviations (Table 3). In addition, perceived rewards (β = −0.33, P < 0.0001) perceived costs (β = −0.17, P = 0.007), fear (β = −0.15, P =

0.013) and response efficiency (β = 0.26, P < 0.0001) predicted significantly the motivation for protection. In general, around 30% of the variance of the protection motivation was predicted by other PMT structures (Table 4).

TABLE 3

TABLE 4

## Discussion

The present study aimed to predict physical activity for preventing falls among older people using the theory of protection motivation among Iranian older people. Recognizing the physical activity and identifying the factors influencing it based on the theoretical framework of the PMT may be helpful in developing appropriate interventions.

According to the results of the study, the constructs of the motivation of protection, fear and response efficacy were the most important predictors of physical activity. Protection motivation shows the highest predictive power of PA behavior, which indicates that the more motivation to perform a behavior, the more likely it expects to do. Similar results were found in a sample of patients with diabetes, where protection motivation was significantly associated with PA behavior [29]. Motivation is an important factor for success in behavior change and there are wide individual differences in why and how people want to make changes [30].

Similar to other studies, there was a significant relationship between the response efficacy with PA behavior and protection motivation, while this relationship was not significant in terms of self-efficacy. Many studies have shown that coping appraisal may improve protective behaviors across different populations. In this regard, the results of one study showed that among PMT variables, self-efficacy and response efficacy constructs were the predictive responses of exercise in the older people [31]. The results of a systematic review indicated that the PMT's coping appraisal construct of self-efficacy appears to be the most effective in promoting physical activity participation [32]. In another study, PMT explained 35 percent and 20 percent of the variance in PA intention and behavior respectively in a Canadian adult population [33]. Perhaps the reason of inconsistency about self-efficacy in our study was related a low level of self-efficacy as the older people felt an inability to perform physical activity. Participants know what to do but had no self-efficacy to exercise. Dominant strategies to increase the perceived self-efficacy in one's ability to take PA behavior could include: using multiple goal setting, performance accomplishments, vicarious experience, providing social support such as verbal reinforcement [34].

According to the results of the study, there is a significant negative correlation between fear and physical activity, which means that with increasing fear of falling, PA behavior is reduced. This is in line with previous research confirming that fear of falling in older people can lead to reduced physical activity [35–37]. Fear of falling may lead to immobility, functional dependence, and it can also be a psychological

variable that leads to decreased physical activity in the older people [38]. Therefore, performance of activities among older people may be affected by fear of falling.

In addition, there was a significant negative correlation between perceived response costs and rewards with protection motivation construct, which indicates a decrease in the intention of doing the PA by increasing the cost of behavior and perceived rewards. This findings is consistent with previous research that found perceived barriers were associated with restrictions of PA [39]. Increasing the cost of consistent behaviors as well as perceived rewards can be an obstacle to activity performance. So, identifying PA barriers and removing them may be effective in increasing PA.

The present study has several strengths. This is one of the few theory-driven studies examining the predictors of PA in older people. Another all of the PMT constructs were tested (i.e., response costs, rewards of maladaptive response and fear) in our study. Unlike previous PMT studies have employed on some of PMT constructs.

The study has also several limitations. One of the limitations of this study is the low level of literacy of more than half of the participants, and the lack of precise completion of questionnaires by some of the participants, as well as evaluation of self-report method, which could be a source of bias in the data. Therefore, future research may consider employing objective measures for examining PA such as pedometer.

# Conclusion

It was concluded that most PMT constructs especially protection motivation were useful in predicting the determinants of PA behavior among older people. Thus, it is recommended to consider protection motivation as the main priority while developing exercise intervention aiming at this population. Also, the mean score for self-efficacy of PMT constructs and PA behavior among Iranian older people were low. Therefore, educational intervention efforts aimed at PA behavior promotion and, consequently, fall prevention among older people are recommended.

# Declarations

*Ethics approval and consent to participate*

Approval to conduct the study was obtained from the Medical Ethics Committee at Hamadan University of Medical Sciences (registration number: IR.UMSHA.REC.1396.911). For data collection, the study was explained to the eligible participants. Informed consent to participate in the study was obtained before completed questionnaire at the retirement centers. The purpose of the plan and how it was done for the participants was explained. Subjects verbally agreed to participate in the study. All participants were informed that they could withdraw from the study at any time.

*Consent for publication*

Consent for publication was obtained.

*Abbreviations*

PMT: Protection Motivation Theory

PA: Physical Activity

RAPA: Rapid Assessment of Physical Activity

CVI: Content Validity Index

CVR: Content Validity Ratio

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# Tables

Table 1. Demographic characteristics of the study sample (n = 300)

| Factor | N | %[a] |
|---|---|---|
| **Age (yr)** | | |
| 60-64 | 180 | 60.0 |
| 65-69 | 69 | 23.0 |
| ≥70 | 51 | 17.0 |
| **Gender** | | |
| Male | 233 | 77.7 |
| Female | 67 | 22.3 |
| **Marital status** | | |
| Married | 266 | 88.7 |
| Widow & Divorced | 34 | 11.3 |
| **Educational level** | | |
| Illiterate | 77 | 25.3 |
| Primary school | 100 | 33.3 |
| Secondary school | 21 | 7.4 |
| High school | 39 | 13.0 |
| University | 63 | 21.1 |
| **Income (Rials)** | | |
| ≥20000000 | 211 | 70.3 |
| <20000000 | 89 | 29.7 |
| **Body mass index (kg/m$^2$)** | | |
| Under weight (<18.5) | 36 | 12.0 |
| Normal weight ( 18.5–24.9 ) | 188 | 62.6 |
| Overweight (≥25.0) | 59 | 19.6 |
| *Co-morbidity* | 225 | 75.0 |
| **Falls in the past 6 months** | 52 | 21.0 |

Note. [a] Percentages may not total 100% because of missing values.

Table 2. Bivariate correlations of PMT variables and physical activity

| Variable | Mean (SD) | Possible range | Severity | Fear | Self-efficacy | Cost | Response efficacy | Rewards | motivation | Physical activity |
|---|---|---|---|---|---|---|---|---|---|---|
| Vulnerability | 9.10(1.84) | 3-15 | .095 | .174** | .059 | .029 | -.006 | .055 | -.094 | -.028 |
| Severity | 11.18(1.83) | 3-15 | | .322** | .116 | .146* | .009 | .196** | -.109 | .129* |
| Fear | 7.73(3.62) | 3-15 | | | .157* | .268** | -.044 | .248** | -.007 | -.253* |
| Self-efficacy | 5.29(2.17) | 2-10 | | | | .169** | .003 | .154* | -.096 | .085 |
| Cost | 6.03(2.33) | 3-15 | | | | | -.200** | .364** | -.316** | -.316** |
| Response efficacy | 7.87(1. 64) | 2-10 | | | | | | -.226** | .357** | .264** |
| Rewards | 6.10(1.13) | 2-10 | | | | | | | -.439** | -.340** |
| motivation | 6.02(1.12) | 2-10 | | | | | | | | .469** |
| Physical activity [a] | 4.65(2.83) | 1-10 | | | | | | | | |

Note. [a] RAPA score

*. significant at the 0.05 level

**. significant at the 0.01 level

**Table 3.** Regression analysis to predict physical activity

| Variables | B | Std. Error | Beta | t | Sig. | R Square | Adjusted R Square |
|---|---|---|---|---|---|---|---|
| **Vulnerability** | .110 | .123 | .050 | .893 | .373 | .328 | .305 |
| **Severity** | -.035 | .051 | -.041 | -.677 | .499 | | |
| Fear | **-.170** | **.049** | **-.218** | **-3.469** | **.001** | | |
| **Self-efficacy** | -.008 | .134 | -.003 | -.061 | .952 | | |
| **Cost** | -.093 | .074 | -.078 | -1.255 | .211 | | |
| Response efficacy | **.234** | **.105** | **.133** | **2.235** | **.026** | | |
| **Rewards** | -.125 | .163 | -.049 | -.764 | .445 | | |
| Protective motivation | **.942** | **.159** | **.383** | **5.911** | **.000** | | |

**Table 4.** Regression analysis to predict protection motivation

| Variables | B | Std. Error | Beta | t | Sig. | R Square | Adjusted R Square |
|---|---|---|---|---|---|---|---|
| **Vulnerability** | -.066 | .051 | -.073 | -1.302 | .194 | .299 | .277 |
| **Severity** | -.034 | .037 | -.054 | -.904 | .367 | | |
| Fear | **-.049** | **.020** | **-.153** | **-2.496** | **.013** | | |
| **Self-efficacy** | -.023 | .055 | -.024 | -.422 | .674 | | |
| Cost | **-.084** | **.030** | **-.172** | **-2.799** | **.006** | | |
| Response efficacy | **.186** | **.042** | **.260** | **4.472** | **.000** | | |
| Rewards | **-.327** | **.064** | **-.317** | **-5.085** | **.000** | | |