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## Psychological, social, and environmental predictors of physical activity among older adults: The socio-ecological approach using structural equation modeling analysis

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## Abstract

Background: Older people are vulnerable groups whose physical activity (PA) guarantees their health. Considering the low level of PA and the role of various factors, this study was designed to investigate the level of PA and its determinants using the socio-ecological approach. Material and methods: In 2016, a random sample of 340 older people in urban areas of the Maku county, West Azerbaijan province, Iran, were recruited to complete PASE (Physical Activity Scale for the Elderly) and a socioecological approach-based questionnaire. Structural equation modeling (SEM) was conducted by Stata. Results: The mean PA in our study was very low ( $94.02 \pm 3.41$ ), and 50% of the participants had insufficient PA. The socio-ecological approach suggested that family support of the social level strongly affects PA ( $\beta = 2.79$ ). Moreover, the psychological level had direct effects on PA ( $\beta = 2.79$ ). The environmental level had effects on PA in a reverse direct as well as an indirect way ( $\beta = -2.09$ ). Conclusions: The socio-ecological approach was found to be helpful in categorizing the determinant factors of PA among Iranian older people. Future research should focus on designing social support and self-efficacy interventional programs with a multilevel approach aiming at PA promotion among elder.

## Keywords

physical activity, social-ecological approach, older people, structural equation modeling

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# Psychological, social, and environmental predictors of physical activity among older adults: The socio-ecological approach using structural equation modeling analysis

## Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Data Interpretation
- E Manuscript Preparation
- F Literature Search
- G Funds Collection

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## abstract

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## INTRODUCTION

Regular physical activity (PA) has different benefits [2-6]. Several studies have shown that only 12-40% of the elderly with PA for health [6-11].

The world's elderly population is increasing [1] Also in Iran, the population of older people in 2012 was 7.5% with an increase of nearly 21% predicted by 2050 [3]. The decreased activity with aging [1, 4-10] requires that the PA behavior of this group of different dimensions needs to be studied. PA, as a multidimensional behavior, is affected by individual, environmental and social factors [12-16].

The social and physical environments are effective in individuals' ability to engage in PA. To increase PA, efforts should be made on both the behavioral choices of individuals and their influential factors [21]. In public health, the socio-ecological approach is one of the model behaviors that show the effects of different levels of a multi-level study. The socio-ecological approach emphasizes that an individual is not separate from the environment in which he lives, and the social and physical environment around the person affects his behavior, particularly PA [22]. The components of this approach include the individual, social, physical environment and policies. The individual factors are at the center of this approach. These factors include awareness, attitude, self-efficacy, etc. The social environment surrounding the individual includes communication, networking, culture and social support.

PA is done in the physical environment that includes the natural or human-made environment [21]. In the socio-ecological approach, each layer affects another layer, and the effects of the layers together cause the formation and promotion of the activity [21]. So it was necessary to define the levels for the elderly upon which plans to intervene could be designed. This approach has been used in many countries for the age group of the elderly [1, 14], The most important predictor was self-efficacy, which directly affected PA, but in Iran, which has a different social and cultural context for the elderly, there is no study in this field. This study aimed to evaluate the different levels of psychological, social and environmental factors of PA in the Iranian elderly and to determine the most important predictors of the levels which may be categorized applying the SEA.

## MATERIAL AND METHOD

### STUDY DESIGN AND PARTICIPANTS

In this cross-sectional study, we aimed to determine the predictors of PA among 340 older people in Maku, West Azerbaijan province, Iran. The appropriate sample size was calculated proportional to the population among health center and the base after gaining the ethics code "IR.TBZMED.REC.1395.767" from Tabriz University of Medical Sciences. Data were collected from September to January 2016.

The inclusion criteria for the respondents were those over 60 years old who could walk, had not been diagnosed with severe mental diseases, had no dementia, had no restrictive musculoskeletal disorders, had no stroke, and had no Parkinson. The researchers called the participations and provided them with explanations about the study. They were invited to attend on a certain day and time at the respective health center or the base. Those not eager to attend the centers were met at their home. Then, all of the participants signed a consent form.

## MEASURES

The PA Scale for the Elderly (PASE), a short form, over the previous seven days [24] was used to measure the level of PA among the participants [25]. This questionnaire evaluated PA at leisure time, household, occupational, and caregiving activities. A single score is computed by multiplying the duration of the activity (hours/week) or participation in an activity (yes/no) by specific scoring weights, and then summing the product for all ten items. The scale ranges from 0 to 400, with a higher score indicative of a higher level of PA [24]. PASE scores were used to classify PA quartiles from the lowest to the highest activity level: quartile 1 (PASE score  $\leq 93$ ), quartile 2 (PASE score 94–146), quartile 3 (PASE score 147–206), and quartile 4 (PASE score  $\geq 206$ ) [26]. The validity and reliability of PASE was approved in Iran.

According to the socio-ecological approach, the factors associated with PA were classified into three levels: psychological, social and environmental.

## PSYCHOLOGICAL LEVEL VARIABLES

The short form of the Iranian Exercise Self-Efficacy Scale [27] was used to measure the belief of the older people in their ability to have PA. An example of the items is as follows: “I can exercise even if I’m too tired”. This questionnaire comprises eight items with a 5-point scaling (1–5). A higher score indicates a better level of PA self-efficacy.

## SOCIAL LEVEL VARIABLES

Social interaction [28] and PA social support were measured. An example of the items for PA social interaction is “Exercising is a way to find new friends.” This questionnaire comprises four items with a 4-point scaling (1–4). A higher score indicates a better level of social interaction.

The scale of PA social support [11] contains 20 items with a 5-point Likert-type scaling (1–5). Five items of this scale assess friends to support and 15 items measure family support. An example of the items is as follows: “Offered to exercise with you.” A higher score indicates a higher level of social support. The validity and reliability of the Persian version scales have been approved in previous studies [12, 27–30].

## ENVIRONMENTAL LEVEL VARIABLES

Participants' perceptions of their neighborhood environment [31] were assessed by an eight-item instrument with a 5-point Likert-type scaling (1–5) such as “My neighborhood offers many opportunities to be physically active”. The validity and reliability of this scale had been proved [12].

## STATISTICAL ANALYSES

Stata version 14.0 was performed to test the fitting of PA models to data extracted from participants. Data were presented by a mean (SD) and frequency (percentage) for quantitative and qualitative variables respectively. To determine the relationship between the physical environment, social support and psychological factors with PA, path analysis was used as a tool of SEM [14] with the identity link function and the maximum approach likelihood. In the theoretical model, it is assumed

social factors influence PA through individual factors. Physical environment influences PA through individual and social factors. We reported path coefficients and correlations as standardized estimates. Two primary tests were conducted to survey the data fit. The practical indicators of fit, according to CFA, include Chi-Square, Root Mean Square Error of Approximation (RMSEA), Root Mean Square Residual (RMSR), Goodness-of-Fit Index (GFI), Comparative Fit Index (CFI) and Adjusted Goodness-of-Fit Index (AGFI). The values for GFI, AGFI and CFI range from 0 to 1 and are derived from comparing a hypothesized model with the independent model; with a value greater than 0.90 indicating an acceptable fit to the data conventionally [32, 33]. P-values < 0.05 were considered as statistically significant.

## RESULTS

The mean PA level of participants was 94.02 (SD = 3.41). Of the 340 participants in this study, 54% (184 people) were with PASE  $\leq$  93 (sedentary), 29% with low activity (PASE 94-146), 11% were moderate active (PASE 147-206) and 5% were intensively active (PASE  $\geq$  206). Associations between demographic characteristics and PA among older people are shown in Table 1.

Table 1. Associations between demographic characteristics and PA among older people

	N	%	PASE Score Mean (SD)	PASE Score for Men Mean (SD)	PASE Score for Women Mean (SD)
Age group					
60-69	201	59.1	114.10(4.36)	102.69(9.59)	102.61(4.04)
70-79	103	30.3	71.22(5.17)	63.98(8.64)	78.60(5.52)
80	36	10.6	47.10(8.06)	40.80(10.49)	57.01(12.60)
<i>P value</i>			<0.001	<0.001	0.001
Education					
illiterate	176	51.8	85.00(3.96)	48.97(7.75)	133(4.14)
primary/intermediate	79	23.2	93.43(8.13)	81.61(10.43)	26(11.47)
diploma & higher	85	25	113.23(7.53)	103.73(11.53)	34(6.94)
<i>P value</i>	-	-	0.003	0.002	<0.001
Occupation					
housewife (retired)	313	92.1	92.60(3.54)	76.09(6.90)	103.43(3.52)
working	27	7.9	12.43(110.44)	99.40(12.55)	173.25(28.64)
<i>P value</i>	-	-	0.158	0.171	0.005
BMI					
normal	97	28.5	85.77(6.90)	88.60(10.42)	81.18(6.58)
overweight	153	45	95.18(5.11)	75.91(8.86)	109.42(5.60)
obese	90	26.5	100.93(5.89)	66.89(14.50)	111.94(5.68)
<i>P value</i>	-	-	0.247	0.439	0.005
Smoking					
Yes	96	28.2	79.76(3.61)	75.75(7.60)	171.98(42.31)
No	244	71.8	99.63(7.70)	(10.53)86.40	103.48(3.48)
<i>P value</i>	-	-	0.009	0.406	0.006
Co-morbidity					
0	101	29.7	101.78(6.17)	88.80(8.59)	120.03(7.95)
1	99	29.1	104.71(6.68)	88.51(12.46)	116.72(6.73)
2	140	41.2	81.67(5.01)	61.29(11.51)	91.76(4.62)
<i>P value</i>	-	-	0.007	0.114	0.01

Mean scores of self-efficacy and family support were low. Significant correlations were seen between PA and all level of the socio-ecological approach, but at the environmental level, this correlation was negative (Table 2).

Table 2. Associations between socio-ecological Approach with PA (N = 340)

Socio-ecological approach levels	Number of items	Possible range	Mean	SD	<i>r</i>	<i>P</i> -value
Psychological level						
Self-efficacy	8	8-40	16.92	10.54	0.38	<0.001
Social level						
social interaction	4	4-16	8.37	3.88	0.38	<0.001
friend support	5	5-25	8.48	5.89	0.34	<0.001
family support	15	15-75	22.6	9.81	0.48	<0.001
Environmental level						
neighborhood	8	8-40	27.4	9.98	-0.33	0.05

Fit indices showed this model to fit data well ( $\chi^2 = 10.85$ , CFI = 0.99, TLI = 0.98, SRMR=0.01, RSMEA=0.07). Although the chi-square test, as a measure of exact fit, indicated a significant result, the measures of exact fit alone were considered to be too strict in the structural equation modeling literature. The effects of environmental, social and psychological level factors on PA are displayed in Figure 1. Structural equation modeling showed that family support had a very strong impact on PA ( $\beta = 2.79$ ) and was the most significant predictor. This level contributed both directly and indirectly to PA (2.70 and 0.83, respectively). Neighborhood had a direct ( $\beta = 0.51$ ) and negatively indirect ( $\beta = -2.61$ ) effect on PA. The path coefficients are shown in Fig. 1.

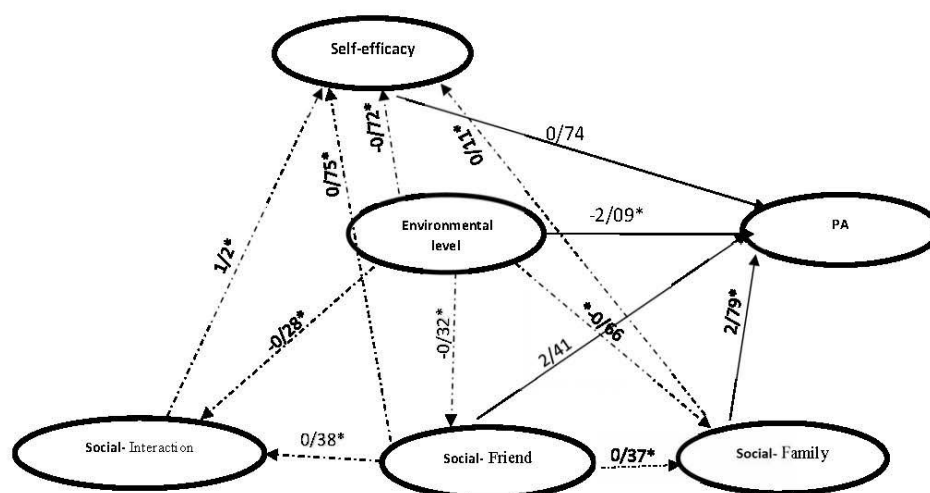


Fig. 1. Psychological, social, and environmental influences on PA among older adults

Table 3 displays the total, direct and indirect effect of the socio-ecological approach on PA. Self-efficacy directly affected PA and increased 0.74 unit score of PA. One unit improvement in self-efficacy, and social factors may increase the odds of PA by 0.09, 2.74, 2.41 and 0.92 units, respectively. However, one-unit improvement in the environmental level may decrease the odds of PA by 2.90. Increasing one unit in the environmental level may decrease the score in the personal level by 0.27 in an indirect mode. Furthermore, the environmental level also indirectly contributed to the factors of the social level. The social level also indirectly contributed to the personal level ( $p \leq 0.05$ ).



Table 3. The total, direct and indirect effect of predictors on PA among older adults (N = 340)

	Direct		Indirect		Total	
	Coefficient	P	Coefficient	P	Coefficient	P
Self-efficacy - PA	0.74	0.09	-	-	0.74	0.09
Family social support - PA	2.70	<0.001	0.83	0.02	2.79	<0.001
Friend social support - PA	0.82	0.23	1.59	<0.001	2.41	0.001
Social interaction - PA	-	-	0.92	<0.001	0.92	<0.001
Physical environment - PA	0.51	0.25	-2.61	<0.001	-2.09	<0.001

## DISCUSSION

In this study, the mean of the PASE score was 94.04 and very low, which was lower than for the elderly in other cities of Iran [34, 35], and the world [36]. The reason for this difference may be the cultural and social conditions in the study area. In the cultural context of Maku, the majority of the activities are carried out by young people. Girls in the family, even if they have independent lives, know that they are going to have a paternity home and do housework; boys also do outside work, such as shopping and repairs.

When older people are walking, it is usually from a place to move him into a car, in which young people usually give way to seniors. This is part of the Iranian culture and shows valuing the elderly, which of course is diluted in large cities. On the other hand, wearing sports clothes and exercising in the Iranian culture is not accepted for the elderly, and it is considered a luxury and luxurious movement. On the other hand, the increase in age leads to a decrease in activity [4-7, 9, 34, 37, 38]. Physiological issues, such as age and the limitations followed by socio-cultural factors can be effective in reducing older people's PA. Therefore, to increase PA in such traditional communities, it must be rooted in the culture, and due to the aging of societies, there is an urgent need for interventions to change the attitude of the society and to increase their PA.

In the present study in the psychological level, the positive relationship between self-efficacy and PA was significant, meaning that with increasing levels of self-efficacy, their level of PA increased. Other studies have shown similar results [36, 39]. Hence it is necessary to promote PA among older people to increase their self-efficacy for PA programs to be created.

In the present study, all factors at the social level showed a positive and significant correlation with PA. Similarly to this study, most studies have shown that social support plays an important role in increasing healthy behaviors, including PA [12, 35, 40]. On the other hand, PA increases social interaction among peers [29] and can play a role in preventing the isolation and loneliness of individuals and their health, because communication with others is one of the basic human needs [41].

In the present study, family social support was the most influential factor in PA. Mansfield et al. considered family social support as one of the most important supporting factors for increasing the activity of mothers [42]. It can be concluded that for certain people in society, such as older people who need the help of others for behaviors, such as PA or healthy eating, family support plays the



most important role. The family helps the elderly to go out of the house with the family to spend their leisure time outdoors, suggesting or preventing activities that increase mobility. Some families find it difficult to travel to the elderly; some people easily travel to the elderly, so the role of family's support is important in improving health promotion, and in particular the PA behavior.

In the present study there was a significant inverse relationship between the physical environment and PA. The result of this study contradicts previous research results [14, 15, 43, 44]. In the majority of studies, access to the physical environment is one of the important factors in promoting PA, which has been found to be inconsistent in the present study. Perhaps one of the reasons for the inconsistency is the cultural differences mentioned above. While Maku city has green and recreational areas and border market for buying, due to the small size of the city limits on access, there is also the traditional culture of limiting mobility for the elderly, the environment cannot exercise this influence.

The results of path analysis (Table 3) shows that the impact of the physical environment is indirectly more suitable for the promotion of PA, but, due to its impact on the social level, it indirectly reduces activity. Given that in most towns and villages of Iran the work culture is that "older people are unable to have a place to sit", this should be changed, and even wearing sports clothes by the elderly should be encouraged, and they should encourage one another's activity. On the other hand, the indoor environment also affects the activity of the older people [45], but this has not been investigated in this study so it cannot be commented upon.

Although most of the research has focused on personal factors, social and ecological models consider social and physical factors accompanied by personal variables to increase PA [15]. Based on findings from the present study, the factors at the psychological, social and environmental levels may have a synergistic impact on PA among older people.

Promoting the factors at the social level may promote the factors at a psychological level. Thus, to increase the level of PA, multiple-level interventions at the psychological and social levels are recommended, within which the two levels of interventions may be considered as the focus of the programs. In the present study, the most significant predictor of PA was the factors at the intrapersonal level, especially family social support. Other studies showed that perceived barriers and cons were important factors to decrease PA [12, 19, 20], and self-efficacy was an important predictor of PA [1, 13, 14].

This discrepancy is due to differences in the studied populations. As mentioned before, in the small towns of Iran, it is the responsibility of the family to take care of the elderly. In Hwang and Kim's study [1], self-efficacy was the most important factor in PA of elderly family. In Korea, although many norms and cultural context have changed, the social environment of the family, especially the support of the spouse and children, has been widely and effectively used to promote the PA of the elderly [1].

In this study, women's activity was higher than that of men, which was inconsistent with some studies [9, 10, 46, 47]. The reason for this in the present study is perhaps because women are more optimistic than men, which has increased social support and eventually increased activity.

Despite its strengths, this study has some limitations. One limitation of this study is that the physical environment inside the house could have been affected by the elderly's activities. Secondly, this study examined some variables and omitted others (e.g. social norm). The psychological, environmental and social factors based on social and ecological models were used to understand PA behavior. "Such correlates could have been added to the model to understand better its relationship to activity in the presence of another factor" [1].

This study has several delimitations. Also, we used the structural equation model to test social, ecological models on PA. Path analysis, the direct, indirect and total effects of factors on PA was done for the first time in Iran among older people. The current study identifies that psychological, physical and social factors could be shown to have direct and indirect influences on PA. The family support of PA was the most significant predictor of this behavior. Based on results, it can be concluded that increasing the family support along with improving self-efficacy can lead to increasing PA and health promotion.

Since in the present study environmental effects were negative in the opposite direction to other studies in the indirect form, it is suggested that the following studies be considered for its reasons, as well as the indoor environment.

## CONCLUSION

The predictors of PA among urban older people in the present study were family support as a social level. The socio-ecological approach was found to be helpful in categorizing the determinant factors of PA among Iranian urban older people.

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