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# The Effect of a TTM-Based Intervention on Level of Physical Activity in ICU Nurses

Saghi Moosavi,[1,*] Rabiollah Farmanbar,[2] Saghar Fatemi,[3] and Mohammad Ali Yazdanipour[4]

[1]Medical Surgical Education Department, Shahid Beheshti Faculty of Nursing and Midwifery, Guilan University of Medical Sciences, Rasht, IR Iran
[2]Social Determinants of Health Research Center, Guilan University of Medical Sciences, Rasht, IR Iran
[3]Independent Researcher, Rasht, IR Iran
[4]Statistic Expert, Faculty of Nursing and Midwifery, Rasht, IR Iran

[*]*Corresponding author*: Saghi Moosavi, Medical Surgical Education Department, Shahid Beheshti Faculty of Nursing and Midwifery, Guilan University of Medical Sciences, Rasht, IR Iran. Tel: +98-1333238053/+98-1333550097, E-mail: saghi_m80@yahoo.com

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## Abstract

**Background:** Theory-oriented interventions play a key role in promoting people's QOL and preventing the risk of immobility. Given this key role and due to the critical nature of nurses' professional duties, this study was performed.
**Objective:** The study aimed to determine the effect of a TTM-based intervention on level of physical activity in ICU nurses working at hospitals affiliated to Guilan University of Medical Sciences.
**Methods:** This randomized controlled trial first selected 82 nurses through the census method in order to determine their SOC, then assigned 68 nurses who were in the first three stages to case and control groups. Valid and reliable data collection tools were used, including a demographic questionnaire and TTM constructs (SOC, GPAQ, SE, DB, and POC). Path analysis of data was performed by Lisrel-8.80. The inter-correlation matrix was determined within the model's constructs and between the constructs and the level of physical activity in order to design and implement the intervention. Two-stage assessment was performed, once immediately after the intervention and again six months later. The data obtained were analyzed using appropriate statistical tests and Pearson correlation coefficient.
**Results:** 82.9% of the participants were in the first three stages of TTM. Immediately after the intervention, 55.9% were in the preparation stage, 44.1% in the pre-contemplation stage, and 76.5% in the contemplation stage. Before the intervention, only 26.5% were in the preparation and 44.1% in pre-contemplation stages. There was a statistically significant difference (P = 0.0001) between the control and case groups immediately and six months after the intervention.
**Conclusion:** TTM-based intervention led to the subjects' placement in higher levels of SOC.

*Keywords:* TTM, Physical Activity, Nurses



## 1. Background

One of the most important problems of the modern world is the reduced level of physical activity. The modern sedentary lifestyle is the cause of many diseases and may be a warning sign for health service planners (1-3). The negative outcomes of immobility and the subsequent diseases have led to 1,240,000 deaths and 1,243,000 years of life lost in 2000 in the Eastern Mediterranean alone (4).

A national study conducted in Iran reported the prevalence of immobility as 76.3% in urban and 58.8% in rural areas in women and men aged 15 - 64 and reported the overall prevalence in the same age group as 67.5% (5).

Promoting lifestyles may necessitate people's increased awareness about the risks and consequences of immobility, but awareness is not enough. Since traditional health training interventions are not very efficient, new theory-based interventions should be implemented within clear frameworks (6).

In addition to implementing health interventions for promoting quality of life, it is also essential to emphasize the implementation of training programs based on theory-oriented approaches and behavioral change models (7, 8). The need for use of the constructs of Stage of Change (SOC) was first introduced by Prochaska (1). Based on the Trans Theoretical Model or TTM, people are at different stages of motivation and preparation for performing behaviors and can take advantage of training interventions no matter their stage of preparation.

The main constructs of the model include SOC (pre-contemplation, contemplation, preparation, action, and maintenance), Process of Change or POC (cognitive and behavioral processes), Decisional Balance or DB, and Self-

Efficacy or SE (9). To date, TTM has been used to change certain behaviors in different groups of people, including quitting smoking, family-centered empowerment, and promoting physical activity (1, 6).

The physical activity level of nurses, especially ICU nurses who are mostly female, is very limited all over the world (10-12). Since nurses are a role model for patients as trainers of health behaviors, they should adhere to a lifestyle of adequate physical activity. The nurses' performance of physical activity is a behavior that significantly affects the outcomes of the instructions they provide to their patients about performing physical activities as part of their therapeutic programs. The regular practice of physical activity not only keeps nurses healthy, but also promotes their communication with patients and improves the quality of health services they provide by improving their mental health (13). This study was conducted to determine the effect of a TTM-based intervention on the level of physical activity in ICU nurses working at teaching hospitals affiliated to Guilan University of Medical Sciences.

## 2. Methods

This randomized, controlled, experimental trial was performed to examine the effect of a TTM-based intervention on the level of physical activity in ICU nurses working at 5 teaching hospitals affiliated to Guilan University of Medical Sciences in 2014. The study population included 82 ICU nurses with bachelor's degree or higher. The study subjects were selected through the census method according to the inclusion criteria of willingness to participate in the study, having no orthopedic diseases, and having at least one year of work experience in ICU. The exclusion criteria included nurses who were in the action or maintenance level of SOC. The study sample size was determined through the following steps:

The first step of the study was descriptive and cross-sectional in which, 82 ICU nurses were evaluated in terms of their SOC, namely pre-contemplation, contemplation, preparation, action, and maintenance.

In the second step, 14 nurses were excluded and 64 nurses who were in the stages of pre-contemplation, contemplation, and preparation were divided as simple random assignment into intervention and control groups (n = 34 in each group).

### 2.1. Ethical Considerations

This research was approved by the research deputy of Guilan University of Medical Sciences. Although subjects were human, the intervention was designed in the form of lectures and practical training by a sports coach and displaying CDs; so, this study did not use a human intervention. The research deputy of Guilan University of Medical University approved this study with the confirmation letter numbered p/3/132/3371. We received an introduction letter from the research deputy to present to the hospitals. We explained the objectives of the study to the subjects, their right to withdraw from the study at any time, and confidentiality of their data. The subjects completed an informed consent. The obtained results were provided to the subjects.

### 2.2. Data Collection Tools

Valid and reliable tools were used in this study, including:

A) A demographic questionnaire consisting of items on age, gender, height, weight, marital status, level of education and type of housing;

B) The Stages of Exercise behavior Change Questionnaire (SECQS): In this questionnaire, the stages of change were examined based on physical activity within five statements, "I do not plan on exercising regularly in the next six months/I plan on exercising regularly during the next six months/I plan on exercising regularly during the next 30 days/I have been exercising regularly for less than six months/I have been exercising regularly for more than six months", which were given in response to the question of "Do you exercise regularly?" The participants were placed at one of the stages (i.e. pre-contemplation, contemplation, preparation, action, and maintenance) based on their answers to the question (6, 14-16). The retest coefficient of this instrument was calculated as 0.92 in this study.

C) The Global Physical Activity Questionnaire (GPAQ): The GPAQ was introduced by WHO to measure the amount of exercise performed based on the Metabolic Equivalent of Task (MET) scale using the following equation:

Weekly exercise score = (Frequency of light exercise per week $\times$ 0) + (Frequency of moderate exercise per week $\times$ 4) + (Frequency of intense exercise per week $\times$ 8)

The retest coefficient for this tool was calculated as 0.80 in this study. The questionnaire consists of 16 items on physical activity in the workplace, at leisure time, at home, during the commute, and while sitting. The cut-off point for the tool was determined as 1600 MET. The subject's level of physical activity per week is extracted and reported in MET minutes/week based on the questionnaire's scoring guideline for self-reports.

Necessary instructions about light, moderate, and intense activity were given to the participants prior to completing the GPAQ (10, 14, 15, 17-19).

D) The Process of Change Questionnaire (PCQ): The PCQ consists of 30 items that is scored based on a five-point Lik-

ert scale (1 point for choosing the 'Never True' option to 5 points for the 'Always True' option). Items 1 to 15 determine cognitive strategies and items 16 - 30 determine behavioral strategies. The Cronbach's alpha reliability of the questionnaire was calculated as 0.91. In the 15 cognitive items, items 1 - 3 are concerned with consciousness raising, items 4-6 with dramatic relief, items 7 - 9 with environmental reevaluation, items 10 - 12 with self-reevaluation, and items 13 - 15 with social liberation. In the 15 behavioral items, items 16 - 18 are concerned with counter conditioning, items 19 - 21 with helping relationships, items 22 - 24 with reinforcement management, items 25 - 27 with self-liberation, and items 28-30 with stimulus control. In this part, the participants choose an option that best describes their experience over the past month and the responses are scored based on the five-point Likert scale previously discussed (15).

E) The Self-Efficacy Scale (SE): The SE was introduced by Nigg and Riebe in 2002 (16). The Cronbach's alpha reliability of the questionnaire contains of 6 items calculated as 0.89.

F) The Decisional Balance Questionnaire (DBQ): Assuming that the respondents are in the stage of deciding about performing exercises or increasing its frequency/intensity, the weight or importance of their opinion is calculated based on their choice of one of the five given options (which are scored based on a five-point Likert scale from 1 point for 'Not Important' to 5 points for 'Extremely Important') for each item in the questionnaire (which consists of five items on facilitators and five items on barriers to the discussed behavior). The Cronbach's alpha reliability of the questionnaire was calculated as 0.93 for facilitators and as 0.75 for barriers.

### 2.3. Validity and Reliability Assessment of the Data Collection Tools

The validity of the data collection tools used in this study was determined through the content validity method. CVI and CVR were calculated by points of view of 10 academic staff and whole the phrases of the questionnaire were accepted by CVR $\geq$ 0.62 and CVI > 0.79 based on Lawshe scale. Their reliability was calculated using Cronbach's alpha and test-retest coefficients. As mentioned in Data collection tools section, Cronbach's alpha of the questionnaires were calculated as follows:

PCQ: The Cronbach's alpha reliability of the questionnaire was calculated as 0.91.

SE: The Cronbach's alpha reliability of the questionnaire was calculated as 0.89.

DBQ: The Cronbach's alpha reliability of the questionnaire was calculated as 0.93 for facilitators and as 0.75 for barriers.

### 2.4. Data Collection

In the first phase of the study, which was descriptive and analytical, the valid and reliable data collection tools designed based on the TTM constructs were administered to 82 nurses. Participants' data on SOC, POC, SE, DB, and MET were collected and analyzed by SPSS-16. The TTM constructs were evaluated and the data were analyzed using path analysis, and training content appropriate for the intervention was developed with an emphasis on the strongest predictors of the behavior in question. After classifying and summarizing the data and determining the SOC, 68 eligible participants who were at the stages of precontemplation, contemplation, and preparation were selected for the second phase of the study. They were then divided into intervention and control groups of 34 each.

TTM-based intervention sessions were designed for the intervention group in the form of lectures and practical training by a sports coach along with the distribution of CDs based on SOC and according to the path analysis results. The sessions were held after arrangements were made with the educational supervisors of hospitals (Table 1). The first stage of intervention assessment was performed immediately after the intervention and the second stage was performed six months later based on the model constructs and in line with the objectives of the study. The final analysis and conclusion were followed (6, 20).

**Table 1.** Interventions Timetable

| Intervention | Description | Time |
|---|---|---|
| **Lecture** | -The benefit of regular physical activity<br>-Time management in relation to physical activity<br>-Effective strategies for physical activity | 9 - 10:30 am |
| **Practical exercise Training** | -Warm-up exercise | 11 – 12 am |
| **Educational CD** | -Isometric practice | 30 minutes/day |

### 2.5. Data Analysis

The data were analyzed in accordance with variable type (i.e. qualitative or quantitative) using descriptive and inferential statistics suitable for data. Participants' age, work experience, and DB, SE, POC, and MET values were taken as continuous quantitative variables, their gender, marital status, and type of housing as nominal qualitative variables, and their level of education and SOC as ordinal qualitative variables. Descriptive inferential statistics were used to analyze and calculate the constructs' mean values

and determine the matrix of correlation within the constructs and between the constructs and physical activity behavior. The level of physical activity, the frequency of SOC, and the scores of SE, DB, and POC were analyzed using descriptive statistics (absolute and relative frequency and mean and standard deviation). The strongest constructs predicting MET were determined using the statistic and modification indices in Lisrel 8.80. The strongest constructs predicting participants' level of physical activity were thus determined alongside their level of physical activity. In the controlled trial part of the study, intergroup differences were determined in terms of changes in the dependent variables from the beginning of the intervention to the end; the changes were first measured immediately after the intervention and again six months later using the independent t test and ANOVA. The repeated measures ANOVA and Friedman's test were used to examine changes in the intervention group at each phase of the study.

## 4. Results

97.6% of the participants were female, 59.8% were married, 92.7% had bachelor's degrees, 7.3% had master's degrees, and 68.3% lived in apartments. The two groups were not significantly different in terms of their demographic variables. The mean and variance of the level of physical activity were 3592.20 $\pm$ 4926.780 in the participants and the distribution of the MET, SOC, POC, SE, and DB variables was normal ($P < 0.05$). According to the results, there was a significant relationship between the intervention (0.0001) and control (0.002) groups before, immediately after, and six months after the intervention as well as between the intervention and control groups immediately and six months after the intervention in terms of SOC in exercise behavior (Table 2). There was also a significant relationship between the intervention and control groups (0.0001) before, immediately after, and six months after the intervention as well as between the intervention and control groups six months after the intervention in terms of MET (Table 3). The POC in exercise varied significantly (0.0001) in the intervention group before, immediately after, and six months after the intervention, and the intervention and control groups differed significantly in terms of POC in exercise before, immediately after, and six months after the intervention (Table 4). There was a significant relationship between SE and physical activity in the intervention group (0.0001) before, immediately after, and six months after the intervention, and there was also a significant difference between the intervention and control groups in terms of the relationship between SE and physical activity before, immediately after, and six months after the intervention (Table 5). There was a significant relationship between the perceived benefits of physical activity in the intervention group (0.02) before, immediately after, and six months after the intervention, and there was a significant difference between the intervention and control groups in terms of the relationship between the perceived benefits of physical activity before, immediately after, and six months after the intervention (Table 6).

## 5. Discussion and Conclusion

Using TTM for prediction of SOC in regular physical activity and evaluation of its constructs before, immediately after, and six months after the intervention is essential for describing physical activity with the aim of maintaining public health and promoting quality of life; it is worth noting that most highly-efficient training programs are based on theory-oriented approaches (7, 8). The results of the present study confirm this fact due to the significant relationship found between the intervention (0.0001) and control (0.002) groups before, immediately after, and six months after the intervention as well as between the intervention and control groups immediately after and six months after the intervention in terms of SOC in exercise behavior. This finding is consistent with the results obtained by Farmanbar on the effect of a TTM-based intervention on SOC in exercise behavior in students of Guilan University of Medical Sciences (6) and the study by Johnson et al. on the effectiveness of a TTM-based intervention for weight control in Boston, US, and the resultant ascending trend from the stage of pre-contemplation to the stage of action before and six months after the intervention along with the maintenance of behavior within 12 and 24 months (21). Participants' improvement from the stage of pre-contemplation to the stage of preparation in the present study therefore appears to be a reasonable change rooted in the TTM-based intervention performed.

The mean and variance of the MET were 2096.35 $\pm$ 2447.92 in the intervention group immediately after the intervention, which followed an upward trend compared to the level of physical activity in this group before the intervention (852.76 $\pm$ 1090.95) as well as compared to the cut-off point presented in the instrument (1600). The results obtained by Ghahremani et al. on the implementation of training interventions for the promotion of MET in old men (22) and those obtained by Shirazi et al. (23) and Farmanbar indicating a significant increase in the level of physical activity and participants' progression in SOC of physical activity after a SOC-based intervention (24) confirm the present findings. The distribution of participants into the five stages (pre-contemplation, contemplation, preparation, action, and maintenance) also showed a significant change. Six months after the intervention,

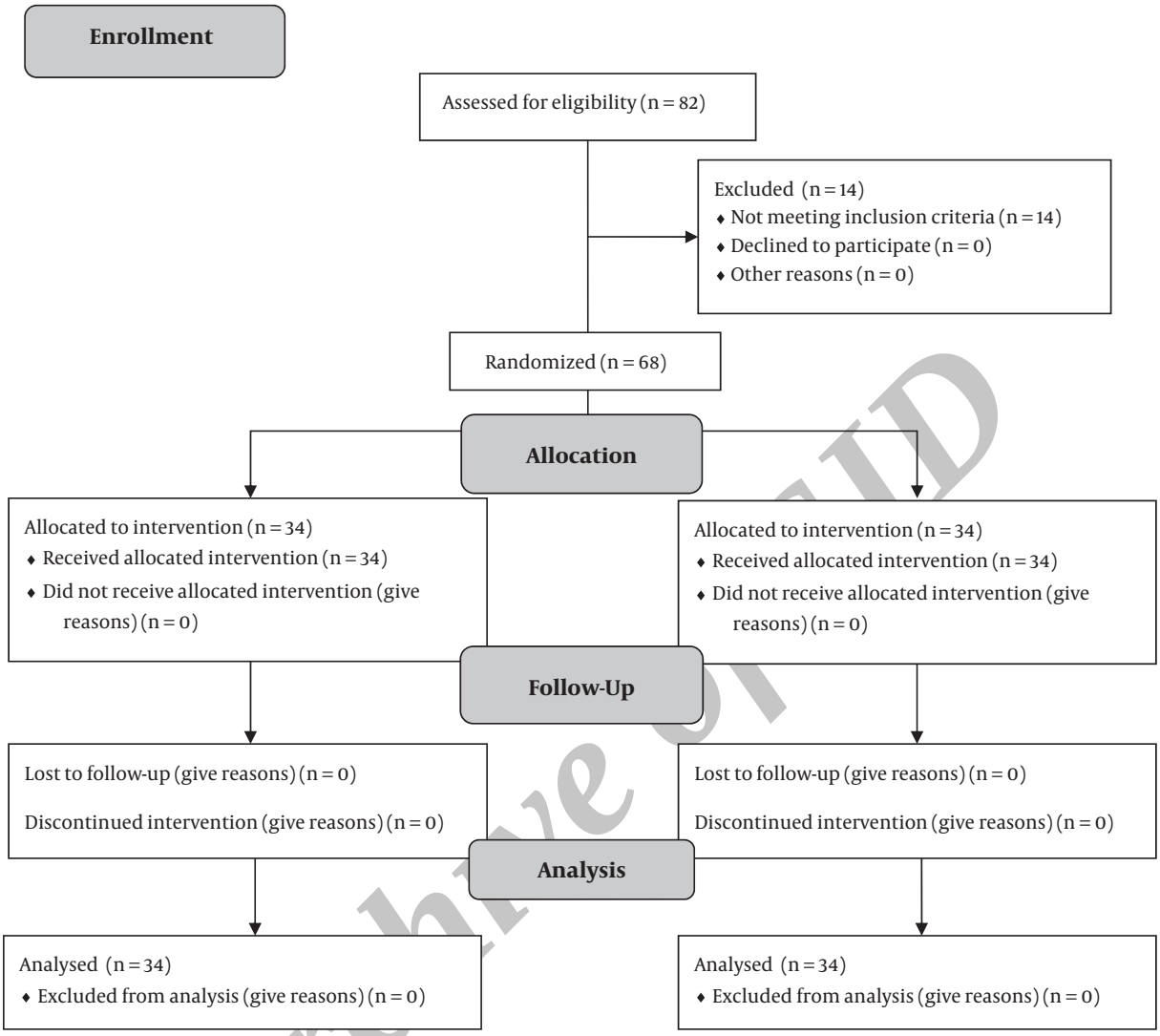


**Figure 1.** CONSORT 2010 Flow Diagram

91.2% of the participants were at the stage of action, 5.9% at the stage of maintenance, and only 2.9% at the stage of preparation. The study conducted by Farmanbar also achieved similar results (24). Lee conducted a study on Korean women and reported a significant change (P = 0.000) from the stage of pre-contemplation to the stage of maintenance (25).

The mean and variance of MET were 3172.58 ± 2813.06 in the intervention group, which followed an upward trend compared to the mean and standard deviation of the level of physical activity before the intervention (852.76 ± 1090.95) as well as compared to the mean and variance of MET immediately after the intervention (2096.35 ± 2447.92), thereby suggesting the effectiveness of the TTM-based intervention. In a similar study on a TTM-based intervention conducted in the US, Melissa et al. obtained similar results and revealed an increase in physical activity levels with this intervention (26).

In the intervention group, participants' distribution in terms of SOC in exercise behavior before the intervention was as follows: 44.1% at the stage of pre-contemplation, 29.4% at the stage of contemplation, and 26.5% at the stage of preparation; immediately after the intervention, 2.9% were at the stage of pre-contemplation, 20.6% at the stage of contemplation, and 55.9% at the stage of preparation, while 17.6% were at the stage of action,

**Table 2.** The Distribution of the Participants by SOC in Physical Activity Behavior in the Intervention and Control Groups Before, Immediately, and Six Months After the Isntervention

| Group | Time | | | | | | P-value Friedman's Test |
|---|---|---|---|---|---|---|---|
| | Before the Intervention | | Immediately After the Intervention | | Six Months After the Intervention | | |
| | Number | Percentage | Number | Percentage | Number | Percentage | |
| **Intervention** | | | | | | | |
| Pre-Contemplation | 15 | 44.1 | 1 | 2.9 | 0 | 0 | 0.0001 |
| Contemplation | 10 | 29.4 | 7 | 20.6 | 0 | 0 | |
| Preparation | 9 | 26.5 | 19 | 55.9 | 1 | 2.9 | |
| Action | 0 | 0 | 0 | 17.6 | 31 | 91.2 | 0.002 |
| Maintenance | 0 | 0 | 1 | 2.9 | 2 | 5.9 | |
| Total | 34 | 100 | 34 | 100 | 34 | 100 | |
| **Control** | | | | | | | |
| Pre-Contemplation | 8 | 23.5 | 3 | 8.8 | 1 | 2.9 | |
| Contemplation | 21 | 61.8 | 28 | 82.4 | 26 | 76.5 | |
| Preparation | 5 | 14.7 | 2 | 5.9 | 5 | 14.7 | |
| Action | 0 | 0 | 1 | 2.9 | 2 | 5.9 | |
| Maintenance | 0 | 0 | 0 | 0 | 0 | 0 | |
| Total | 34 | 100 | 34 | 100 | 34 | 100 | |
| **P-value mann-whitney's test** | | 0.51 | | 0.0001 | | 0.0001 | |

**Table 3.** The Mean, Standard Deviation, and Significance Level of the Level of Physical Activity (MET) in the Intervention and Control Groups Before, Immediately, and Six Months After the Intervention

| Group | Time | | | | | | P-value Friedman's Test |
|---|---|---|---|---|---|---|---|
| | Before the Intervention | | Immediately After the Intervention | | Six Months After the Intervention | | |
| | Mean | Standard Deviation | Mean | Standard Deviation | Mean | Standard Deviation | |
| **Intervention** | 852.76 | 1090.95 | 2096.35 | 2447.92 | 2813.06 | 3172.58 | 0.0001 |
| **Control** | 634.94 | 492.12 | 914.12 | 1091.87 | 1196.47 | 1441.29 | 0.0001 |
| **P-value mann-whitney's test** | 1 | | 0,13 | | 0.02 | | |

**Table 4.** The Mean, Standard Deviation, and Significance Level of POC in the Intervention and Control Groups Before, Immediately, and Six Months After the Intervention

| Group | Time | | | | | | P-Value Repeated Measures ANOVA |
|---|---|---|---|---|---|---|---|
| | Before the Intervention | | Immediately After the Intervention | | Six Months After the Intervention | | |
| | Mean | Standard Deviation | Mean | Standard Deviation | Mean | Standard Deviation | |
| **Intervention** | 3.31 | 055 | 3.89 | 0.55 | 4.14 | 0.42 | 0.0001 |
| **Control** | 0.03 | 0.66 | 2.90 | 0.53 | 3.04 | 0.57 | 0.13 |
| **P-value t-test** | 0.06 | | 0.0001 | | 0.0001 | | |

and 2.9% at the stage of maintenance. Six months after the intervention, the distribution of participants into SOC changed in a way that 91.2% were at the stage of action, 5.9% at the stage of maintenance, and only 2.9% at the stage of preparation (P = 0.0001). In the control group, participants' distribution in terms of SOC was as follows: 23.5% at the stage of pre-contemplation, 61.8% at the stage of contemplation, and 14.5% at the stage of preparation; these

**Table 5.** The Mean, Standard Deviation, and Significance Level of Self-Efficacy (SE) in the Intervention and Control Groups Before, Immediately, and Six Months After the Intervention

| Group | Time | | | | | | P-Value Repeated Measures ANOVA |
|---|---|---|---|---|---|---|---|
| | Before the Intervention | | Immediately After the Intervention | | Six Months After the Intervention | | |
| | Mean | Standard Deviation | Mean | Standard Deviation | Mean | Standard Deviation | |
| **Intervention** | 2.33 | 0.91 | 3.21 | 0.86 | 3.81 | 0.88 | 0.0001 |
| **Control** | 1.87 | 0.76 | 1.83 | 0.85 | 1.86 | 0.99 | 0.90 |
| **P-value t-test** | 0.03 | | 0.0001 | | 0.0001 | | |

**Table 6.** The Mean, Standard Deviation, and Significance Level of Perceived Benefits of Physical Activity in the Intervention and Control Groups Before, Immediately, and Six Months After the Intervention

| Group | Time | | | | | | P-Value Repeated Measures ANOVA |
|---|---|---|---|---|---|---|---|
| | Before the Intervention | | Immediately After the Intervention | | Six Months After the Intervention | | |
| | Mean | Standard Deviation | Mean | Standard Deviation | Mean | Standard Deviation | |
| **Intervention** | 3.03 | 0.59 | 3.22 | 0.37 | 3.36 | 0.45 | 0.02 |
| **Control** | 2.58 | 0.75 | 2.53 | 0.71 | 2.57 | 0.63 | 0.83 |
| **P-value t-test** | 0.007 | | 0.0001 | | 0.0001 | | |

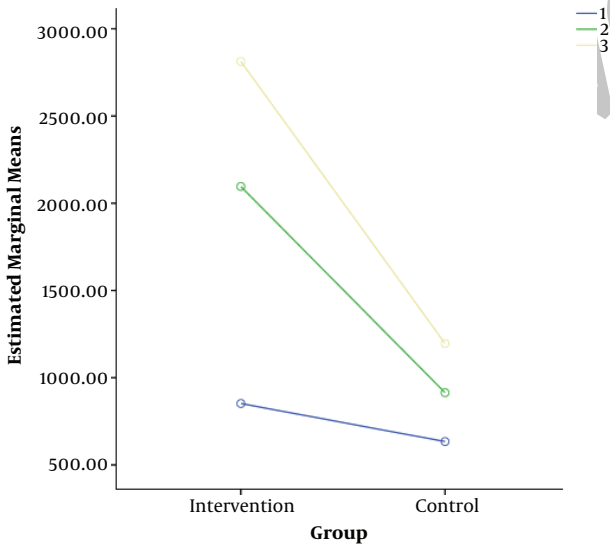


**Figure 2.** Estimated Marginal Means of MET

values changed to 8.8%, 82.4%, and 5.9% immediately after the intervention; moreover, 2.9% of the participants were at the stage of action at this point in the study. Six months after the intervention, participants' distribution changed to 76.5% being at the contemplation stage, 14.7% at the preparation stage, and 5.9% at the action stage (P = 0.002). Based on the statistical tests performed immediately and six months after the intervention, a significant difference existed between the intervention and control groups (P = 0.0001). In their study on the effectiveness of a TTM-based intervention in weight control in intervention and control groups within 6, 12, and 24 months, Johnson et al. reported SOC as 43%, 37.7%, and 44.9% in the intervention group and 34.6%, 35.9%, and 38.1% in the control group from the action stage to the maintenance stage, suggesting a significant difference (P = 0.05) (19). According to the present research, the significant difference between the intervention and control groups on the three occasions was attributed to the implementation of an effective TTM-based intervention for ICU nurses.

The mean and variance of MET in the intervention and control groups were 852.76 ± 1090.95 and 634.94 ± 492.28 before the intervention, 2096.35 ± 2447.92 and 914.12 ± 1091.87 immediately after the intervention, and 3172.58 ± 2813.06 and 1196.47 ± 1441.29 six months after the intervention, respectively. The two groups were significantly different in terms of these mean values before, immediately after, and six months after the intervention (P = 0.0001). Meanwhile, there was a significant difference between the intervention and control groups in terms of MET six months after the intervention (P = 0.02). In another study, Hazavei et al. observed a significant difference be-

tween their intervention and control groups in terms of MET after intervention (27). The study by Opdenacker et al., however, showed inconsistent findings, which appears reasonable given that their training intervention was briefly provided in only one session along with some reminder notes (28). According to the present research, the development of a training program based on TTM, the multiplicity of training sessions, and the use of a combination of lectures, practical exercises, films, and instructional pamphlet for training have contributed to the positive results obtained. Similarly, Heesch (2006) found that the exercises performed and the scores obtained were correlated in a TTM-based intervention performed for physical activity and lifestyle improvement (29).

In the present study, the mean score of POC followed an upward trend in the intervention group before, immediately after, and six months after the intervention and showed a significant difference compared to the control group (P = 0.0001), as the trend of changes was not significant in the control group. No significant differences were observed between the intervention and control groups before the intervention in terms of the mean score of POC (cognitive-behavioral) in physical activity, while the two groups were significantly different in this regard immediately and six months after the intervention (P = 0.0001). The upward trend of the mean score of POC (cognitive-behavioral) in physical activity in the intervention group suggests the effectiveness of the training intervention performed on the participants, which is also consistent with the results obtained by Farmanbar and Dishman et al. on the role of POC (cognitive-behavioral) in the maintenance and promotion of health in the society through physical activities (24, 30). The promotion and maintenance of physical activities therefore require a progression from cognitive POC to behavioral POC. According to the present research, people need regular programs of learning experience, self-reevaluation, environmental reevaluation, and counter conditioning accessible through TTM-based interventions in order to promote their POC in physical activity.

The mean score of SE showed a significant difference before, immediately after, and six months after the intervention in the intervention group (P = 0.0001); however, no significant differences were observed in the control group. A significant difference was also observed between the intervention and control groups in terms of the mean score of SE before, immediately after, and six months after the intervention (P = 0.0001). These results are consistent with the results obtained by Farmanbar (24). Moori et al. also reported a relationship between SE and people's placement in higher levels of the SOC constructs in young and middle-aged Japanese men (30). In a similar study, Melissa emphasized the relationship between SE as an important factor for the maintenance of physical activity based on the changes in the mean score of SE (0.20) in the participants remaining at the maintenance stage of weight stabilization behavior and the mean score of SE (0.33) in the participants whose weight stabilization behavior had not yet reached the stage of maintenance even 12 months after the intervention (26). According the present research, the SE construct is an important factor that connects consciousness to action and it can be considered a variable affecting health behaviors. Vahedian et al. also introduced SE as the most important factor involved in promoting the level of physical activity (31).

The mean score of DB showed a significant difference in the intervention group before, immediately, and six months after the intervention (P = 0.02); however, no significant differences of this sort were observed in the control group. A significant difference was observed between the intervention and control groups in terms of the mean score of DB before (P = 0.007), immediately, and six months after the intervention (P = 0.0001). The TTM-based intervention therefore appears to increase the mean score of DB. Dishman et al. also emphasized the effect of TTM-based interventions on the maintenance and promotion of physical activities and argued that this model is effective in POC and DB, as well (32). Vahedian et al. also showed a significant relationship (P = 0.011) between SOC, level of physical activity, SE, and DB (31).



## Footnote

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