

# Improving physical activity in ‘Health Volunteers’: A randomized controlled trial

**Khadijeh Jafarpour**

Ahvaz

**Ali Asghar Arastoo**

Ahvaz Jondishapour University of Medical Sciences

**Zeinab Gholammnia-Shirvani**

Babol University of Medical Science Faculty of Medicine

**Ali Montazeri**

Iranian Institute for Health Sciences Research

**Ali Asghar Haeri-Mehrzi**

Iranian Institute for Health Sciences Research

**Marzieh Araban** (✉ [araban62@gmail.com](mailto:araban62@gmail.com))

Ahvaz Jondishapour University of Medical Sciences Faculty of Public Health <https://orcid.org/0000-0001-9920-0261>

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## Research

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# Abstract

## Background

Health volunteers are women who have humanistic cooperation with healthcare centers to prevent diseases. Health volunteers play an important role in the community. Thus if educated, they could be of great help to health care systems. Since physical inactivity and sedentary lifestyles increase the risk of all cause mortality, the aim of this study was to educate health volunteers on physical activity (PA) applying the theory of planned behavior (TPB).

## Methods

This was a randomized controlled trial of an educational intervention to improve physical activity among health volunteers in Shushtar (a southern city), Iran in 2016. A sample of female health volunteers was entered into the study and randomly was assigned to the intervention and the control groups. The intervention included three educational sessions and a walking program. A questionnaire containing items on TPB constructs including: attitude, subjective norms, perceived behavioral control, intention and behavior constructs, the international physical activity questionnaire, and the physiological cost index (PCI- an objective measure of PA) were used to collect data at baseline and 6 months follow-up assessments. Then the data were compared within and between groups using t-test and paired test.

## Results

In all 110 'Health Volunteers' (55 per each group) were entered into the study. The mean age of participants was  $35.65 \pm 10.25$  years. The results obtained from analysis showed that educational program improved attitude towards PA, perceived behavioral control, intention, behavior and PCI among the intervention group ( $P < 0.001$ ). However, no significant changes occurred in the control group in terms of the study variables ( $P > 0.05$ ). Additionally, comparison of score changes between two groups showed significant differences for all variables except for subjective norms and physical activity behavior (minute per day) group ( $P > 0.05$ ).

## Conclusion

The TPB-directed educational program improved physical activity and physiological cost index. The study framework might be used as a practical template for interventions aimed at improving physical activity among women.

## Background

As recommended by the World Health Organization (WHO), the amount of PA required for individuals aged 18–65 years is at least 150 minutes of moderate PA per week, or 75 minutes of vigorous PA per week, or even a balanced mix of these activities [1]. However, in general, one out of every three adults around the world is not active enough [2] and such inactivity is higher among females as compared to males [5]. Almost 50% of women in the Eastern Mediterranean Region are not active enough, In Iran, Only 18.2% of women exercise at least 10 minutes a day, a value equal to 41.7% among men[3].

It is reported that inactivity among women might lead to several health problems including obesity, diabetes, cardiovascular disease, and depression [2]. Also, lowered quality of life, increased health care costs and increased mortality rate have been associated with physical inactivity. This problem is reported to be an important factor in developing over the 35 chronic diseases/conditions [4].

Given the importance of non-communicable diseases (NCDs) prevention [5] and the contribution of inactivity to the development of NCDs establishing a good strategy that could actually lead to behavior change is required. In this regard, applying theory-based behavioral interventions have been suggested [6]. The theory of planned behavior (TPB) can be used to explain the beliefs, attitudes, subjective norms, perceived behavioral control, and intention and behavior of individuals regarding PA [7]. TPB constructs could be influenced based on the consequences of personal experience with a given behavior; or positive beliefs about the consequences of a given behavior that in turn later also could play a role in motivation for a behavior continuation [8–11]. Although the effectiveness of TPB in improving physical activity among women has been established [3, 12], the results of systematic reviews elaborated the need for more TPB interventions [13].

In fact, women play a key role in family management, hence the effect of their mortality, disability, and behavior on different dimensions of behavioral health and the culture of other family members [14]. This issue raises the importance of attention to health and health-related behaviors such as PA among women, who also play an important role in shaping an active lifestyle within family and society [15]. Health volunteers are women who have humanistic cooperation with healthcare centers to prevent diseases and maintain and promote health among neighbors under the coverage of healthcare services in Iran. They can improve community health by disseminating health related topics. Being aware of community needs, and familiar to the language, culture and beliefs of the population under the cover of health services make their role important in achieving community health goals and they could be as a role model in adhering to health behaviors[16]. The most important tasks of health volunteers are to teach health-related issues to families and create a connection between healthcare centers and the public [17]. This issue further underscores the importance of education in this target population, especially in countries where there is a crisis of human resources for health [18]. For instance a study on implementation of active case detection of visceral Leishmaniasis along with leprosy through female community health volunteers in Nepal echoed this and highlighted that female community health volunteers should be provided sufficient knowledge to use them in community based active case detection of visceral Leishmaniasis and leprosy[19].

Although some studies used TPB as a framework for improving health behavior [3, 12] [5], as far as the authors of this article are concerned, no TPB-based educational intervention has been implemented to promote PA in health volunteers as an informal health personnel, Thus, the aim of this study was to improve TPB constructs and PA level among health volunteers in Iran through manipulating TPB constructs.

## **Methods**

### **Trial Design and sampling procedure**

This was a randomized controlled trial conducted on 110 female health volunteers in Shushtar (a southern city), Iran from March to December 2016.

### **Participants**

The participants were randomized into intervention and control groups based on 1:1 ratio in a single block. The inclusion criteria were as follows: a minimum one-year experience of cooperation with healthcare centers, no problems in terms of participation in educational classes, consent to participate in the research study, ability to read and write, and lack of any apparent of diseases influencing PA i.e, sever cardiovascular disease, loss of balance, confirmed by their health records. The exclusion criteria comprised of unwillingness to cooperate, contraindication to PA for example bone fracture, and migration to other cities during the study period.

### **Intervention**

The educational intervention was designed in accordance with the pre-test results of the TPB-based questionnaire. Three educational sessions were held during two consecutive weeks. In the first session (week), a 45-minute lecture was presented using slides and a video projector on the importance of PA and its positive effects on physical, mental, and social aspects. The purpose of this session was to raise awareness among health volunteers, engage their attention, and also prepare them emotionally in terms of PA.

The second session (week) lasted 60 minutes in order to influence the constructs of attitude, subjective norm, perceived behavioral control, and behavioral intention through lecture method, Question-and-Answer method, and group discussion. In order to establish the desired attitudes, overcome the negative ones, and reinforce positive attitudes towards PA, the required information was presented on the beneficial effects of physical activities on people's health, the positive impact on changing risk factors, reducing the risk of illnesses and also increased quality of life. Regarding the influence of subjective norms on PA, the views of specialists were emphasized. An educational pamphlet was further distributed among health volunteers for their family members. To add to the perceived behavioral control, the study participants were asked to speak about the amount of their control on physical activity behavior. Similarly discussed were the easiness and manageability of behavior, planning for time and place, incentives and disincentives of PA, and how to overcome barriers to behavior.

The third session was also held in order to influence the perceived behavioral control, intention, and behavior for 60 minutes. Since individuals make efforts for controllable and applicable behaviors, discussions were focused on the factors facilitating behavior, providing incentives, and reducing barriers in order to influence the construct of the perceived behavioral control. Moreover, breaking behaviors into small steps along with encouragements were among other employed strategies. The given program was designed to gradually lead an individual to do 150 minutes of moderate-intensity PA per week for a period of six months. At 6-months follow-up, participants were contacted to complete the questionnaires.

## Outcome measures

The following questionnaires were used to collect data:

1. *TPB constructs questionnaire*: We used a valid and reliable TPB-based questionnaire developed by Gholamnia et al. to assess the behavioral determinants of PA. This 18-item questionnaire is comprised of attitude towards behavior, subjective norms, perceived behavioral control, intention and behavior constructs. All the items were answered on a five-point Likert-type scale (scores range from 1 to 5) with the exception of two items associated with the construct of behavior. These items were related to the number of days and minutes of PA per week [3]. The target behavior was considered according to WHO recommendation, which is 5 days a week, at least 30 minutes of moderate intensity PA [20]. The total score range for the theory-based scale was 16 to 90 [3]. The psychometric properties of this scale have been previously assessed [21-23]. The questionnaire was distributed among 30 individuals of the target group excluded from the study participants. The mean of the Cronbach's alpha coefficient for the constructs was equal to 0.88. The stability was evaluated through the test-retest method with an interval of two weeks, and the scores were compared using the Intra-class Correlation Coefficient (ICC). ICC of more than 0.61 was considered satisfactory [24]. The mean ICC for the constructs of the questionnaire was equal to 0.73.
2. *Physical Activity Readiness Questionnaire (PARQ)*: Physical Activity Readiness Questionnaire (PARQ) determines the medical condition and readiness prior to starting a PA program, and specifies if further evaluations are required [25]. The Persian version of this questionnaire is available [26] whose validity and reliability have been confirmed [27].
3. *International Physical Activity Questionnaire (IPAQ)*: The short form of the International Physical Activity Questionnaire (IPAQ) was used. According to the questionnaire instructions, the intensity of total PA of each person based on the amount of energy consumed over the past 7 days is placed in one of the three groups of Light, Moderate, and High. The activities lasting lower than 10 minutes are excluded from this calculation [28]. Walking, moderate, and high PA account for 3.3, 4, and 8 metabolic equivalents (MET), respectively. It is to be noted that an MET represents the amount of energy used per minute by an individual at rest [29]. To calculate the total amount of PA per week, the amount of walking (MET×minute×day), moderate (MET×minute×day), and vigorous PA by an individual (MET×minute×day) over the last week are brought together [28]. The given questionnaire is also suitable for determining PA among adults aged 15-69 years. It has been also used in numerous

studies and its validity and reliability have been confirmed [30]. This scale was earlier translated to Persian [29].

4. *Physiological cost index*: The physiological cost index has been suggested to measure the cost of energy consumed during walking and refers to the difference between heart rate during resting and walking divided by the average speed of walking [31]. Among the notable advantages of this index in science and health centers are its easy use and no need for sophisticated equipment. In addition, the integration of heart rate variability and physical activity (average walking speed) is a reliable indicator of study physiological energy used during activities by an examined individual [31]. To calculate the PCI, the health volunteers' heart rates were measured telemetrically by Polar Heart Rate Monitor (made in Finland, the RC3 GPS model) in the healthcare center, and was recorded in the relevant form. The individuals in the target group became familiar with this device in one session. Further considerations were the required standards for the implementation of the given test, meaning, the health volunteer remained seated on a standard chair for 5 minutes (rest period). The health volunteers were asked not to think of any exciting incidences during testing in case their heart rate was influenced. At the end of the five-minute rest period, the study participant started walking around the gym on an oval shape walk-path as long as 100 meters (walk period). Following the cessation of the walk period, the individuals rested on a chair for five minutes. In total, three rest periods and three walk periods were followed continuously. The telemetric measurements of heart rates were taken in the recorder during rest and walk periods. The Polar software and site telemetry warrant unloading of data from recorder to computer for further analysis.

## Sample size

Sample size was estimated by a statistical power analysis. The primary outcome of the study was to measure score changes to be observed for attitude towards physical activity as the most important determinant of PA. Thus, to detect a 1.6 point increase in the baseline attitude towards physical activity at 5% significance, the study would require a sample of 50 females per study group; considering a 10% dropout in the study samples, each study group would have 55 participants. A 90% power was considered for the study.

## Randomization

At first, a list of health volunteers affiliated with Shushtar Health Care Health System was provided. Randomization was achieved using sealed, opaque, sequentially numbered envelopes developed from a random number generator. A research assistant not involved in the recruitment of participants developed the envelopes. This procedure was continued to reach the required number of participants. The study participants were randomized into two groups of intervention and control (55 individuals per group). The intervention was conducted in the Hall of Shushtar Health System. A health care provider blinded to group's assignment assessed both groups in terms of demographic variables, constructs of TPB, amount

of PA, and PCI at baseline. Because of the nature of the intervention in the current study, unlike the participants and statistical investigator, the instructor was not blinded to the group assignment.

## **Statistical analysis**

The obtained data were analyzed by the SPSS Version 19 (SPSS Inc., Chicago, IL, USA) Software at a significant level of 0.05. The Kolmogorov-Smirnov test was initially used to examine the normal distribution of data. In order to ensure the homogeneity of the intervention and control groups, the independent t-test was employed for quantitative variables. The Chi-square test was used for categorical variables. Further evaluated was the effect of educational program on the TPB constructs, PA and the PCI (at baseline and six months follow-up) in two groups of intervention and control. The paired t-test and ANOVA were employed to assess the difference within and between groups in terms of continuous variables, including attitude towards behavior, subjective norms, perceived behavioral control, behavioral intention, behavior, physical activity (day per week), physical activity (minute per day) and PCI (beat/minute), respectively. Mean scores between the two groups were compared using an independent t-test. Also, we assessed the frequency of PA level and intensity between and within the control and intervention group pre and post-intervention by chi-square test.

## **Ethics**

Informed written consent was obtained from all participants, and the study was approved by the ethics committee of Ahvaz Jundishapur University of Medical Sciences (CODE IR.AJUMS.REC.1395.274).

## **Results**

Totally, 110 health volunteers with a mean age of  $35.71 \pm 35.5$  participated in this study. Figure 1 shows the flow diagram of the study. The intervention and control groups were not also significantly different in terms of demographic variables (Table 1).

Table 1

Demographic and background variables in the intervention and control groups at baseline (n = 110)

Variable	Intervention (n = 55)		Control (n = 55)		P-value
	Mean (SD)	No. (%)	Mean (SD)	No. (%)	
Age	34.37(3.96)		35.02(4.96)		0.67*
Number of children	1.78 ± 2.1		1.73 ± 2.1		0.74*
BMI	26.65 ± 5.15		27.02 ± 5.13		0.70*
<b>Marital status</b>					0.90**
Married		50 (90.1)		48 (87.3)	
Single		5 (9.9)		7 (12.7)	
Education					0.42**
≤ Secondary		23 (41.8)		25 (45.4)	
> Higher		32 (58.2)		30 (54.6)	
<b>Husband's education</b>					0.94**
≤ Secondary		38 (69.5)		39 (70.9)	
> Higher		17 (29.5)		16 (29.1)	
<b>Occupation</b>					0.84**
Employee		21 (38.2)		20 (36.6)	
House wife		34 (61.8)		35 (63.4)	
<b>History of chronic disease</b>					0.99**
Yes		4 (7.3)		4 (7.3)	
No		51 (92.7)		51 (92.7)	
*Independent t-test, ** Chi-square test					

The paired t-test indicated a significant difference between the baseline and follow-up within the intervention group ( $p < 0.05$ ) regarding the mean of the TPB variables, days and minutes per week for physical activity, and the PCI; no such difference was observed in the control group ( $p \geq 0.05$ ). The independent t-test showed a significant difference between the two groups regarding the above-mentioned variables at baseline and post education ( $p < 0.05$ ). However, the subjective norms were not significantly different within and between each group at baseline and post intervention ( $p \geq 0.05$ ) (Table 2).

Table 2  
 TPB constructs, physical activity, and PCI in the intervention and control groups at baseline and follow-up

	Group	Baseline	Follow-up	P-value*
		Mean ± SD	Mean ± SD	
Attitude towards behavior	Intervention	18.24 ± 2.16	20.32 ± 3.63	∅0.001
	Control	18.25 ± 2.12	18.45 ± 2.13	0.87
	**P-value	0.79	∅0.001	
Subjective norms	Intervention	11.84 ± 2.69	12.96 ± 2.66	0.65
	Control	11.85 ± 2.13	11.87 ± 2.13	0.85
	**P-value	0.86	0.87	
Perceived behavioral control	Intervention	4.65 ± 2.45	6.68 ± 2.15	0.04
	Control	4.85 ± 2.43	4.86 ± 4.43	0.83
	**P-value	0.45	0.01	
Behavioral intention	Intervention	11.44 ± 3.15	12.87 ± 2.44	0.03
	Control	11.45 ± 3.23	11.44 ± 3.23	0.31
	**P-value	0.86	∅0.001	
Behavior	Intervention	20.35 ± 3.63	23.68 ± 2.89	0.01
	Control	20.34 ± 3.23	20.32 ± 3.23	0.98
	**P-value	0.97	∅0.001	
Physical activity (day per week)	Intervention	1.75 ± 2.17	7.32 ± 0.79	0.001
	Control	3.25 ± 2.17	3.25 ± 2.17	0.62
	**P-value	0.82	∅0.001	
Physical activity (minute per day)	Intervention	71.87 ± 60.54	98.98 ± 55.01	∅0.001
	Control	84.87 ± 95.64	85.85 ± 98.85	0.53
	**P-value	0.87	∅0.001	
PCI (beat/minute)	Intervention	0.55 ± 0.32	0.14 ± 0.11	∅0.03
	Control	0.53 ± 0.31	0.31 ± 0.53	0.87
	**P-value	0.73	∅0.001	
*Paired t-test, **ANOVA				

The within-group responses to the intervention were assessed by calculating the changes in the measures from pre-test to post-test, with positive values indicating an increase, and negative values indicating a decrease in TPB constructs and variables and indicating an improve in these variables situation. However, more decrease indicated a better value for PCI. Table 3 Group comparison showed that the differences of Attitude towards behavior, Perceived behavioral control, Behavior, Physical activity (day per week), and PCI were significant at a  $p < 0.05$  level. No significant change could be detected for perceived barriers ( $p > 0.05$ ; Table 4).

Table 3  
Comparison of score changes between two groups

	<b>Intervention (55)</b>	<b>Control (55)</b>	
	<b>Mean change* (SD)</b>	<b>Mean change* (SD)</b>	<b>P**</b>
Attitude towards behavior	2.08 (4.62)	0.2 (3.18)	0.015
Subjective norms	1.12 (3.84)	0.02 (3.14)	0.103
Perceived behavioral control	2.03 (3.34)	0.01 (5.32)	0.019
Behavioral intention	1.43 (4.10)	-0.01 (4.36)	0.077
Behavior	3.33 (4.58)	-0.02 (4.03)	0.0001
Physical activity (day per week)	5.57 (2.43)	0.00 (2.91)	0.0001
Physical activity (minute per day)	27.11 (92.49)	0.98 (130.50)	0.229
PCI (beat/minute)	-0.41 (0.23)	-0.22 (0.35)	0.001
* Follow-up score minus baseline score			
** Derive from t test			

Table 4

The level and intensity of physical activity in the intervention and control groups at baseline and follow-up

Group	Physical activity	Baseline	Follow-up	Chi-square
		No (%)	No (%)	(P-value)
Intervention	*No Active	40 (72.7)	1 (1.8)	77.165 ( $< 0.0001$ )
	Less Active	13 (23.63)	9 (16.4)	
	Active	2 (3.6)	45 (81.8)	
Control	No Active	42 (76.4)	42 (76.4)	.000 (1)
	Less Active	12 (21.8)	12 (21.8)	
	Active	1 (1.8)	1 (1.8)	
Chi-square (P-value)		0.422 (.81)	81.609 ( $< 0.0001$ )	
Intervention	**Light	49 (89.1)	8 (14.54)	62.168 ( $< 0.0001$ )
	Moderate	4 (7.3)	42 (76.36)	
	High	2 (3.6)	5 (9.90)	
Control	Light	50 (90.9)	48 (82.27)	.384 (.82)
	Moderate	3 (5.4)	4 (7.27)	
	High	2 (3.6)	3 (5.45)	
Chi-square (P-value)		0.153 (92.6)	60.463 ( $< 0.0001$ )	
*No active: Zero minute of moderate-intensity physical activity per week				
Less active: Less than 150 minutes of moderate-intensity physical activity per week				
Active: 150 minutes or more of moderate-intensity physical activity per week				
**Light: Provided that there was no report in the questionnaire and the individuals had no low conditions				
Moderate: A combination of moderate and high physical activities or walking during at least 5 days had reached 600 MET-min/week				
High: Total energy spent for high physical activity during at least 3 days out of the past 7 days had reached 1500 MET-min/week or the total energy spent over the past 7 days for performing a mix of moderate-intensity activities or walking had reached at least 3000 MET-min/week.				

Only 2.7% of the participants were active, and 6.3% had moderate-intensity PA at baseline. The chi-square test indicated a significant difference in the frequency of PA level and intensity before and after education in the intervention group ( $p < 0.05$ ). However, this change did not occur in the control group ( $p \geq 0.05$ ). The two groups were significantly different at 6 months, according to the chi-square test ( $p < 0.05$ ) (Table 4).

## Discussion

This study evaluated the effectiveness of a theory-based health education program on improving PA and the PCI among health volunteers. Only 2.7% of the health volunteers were adequately active at baseline. Implementing the TPB-based educational program augmented the scores of the construct of attitudes towards behavior at 6-months follow-up in the intervention group. This result is consistent with the findings of Lachlan et al. [32]. A clinical trial by Darker et al. on walking improvement based on TPB reported a similar increase in individuals' attitudes towards PA [33]. However, this finding is not in line with Mok and Lee's study, where attitude towards PA did not change over the study period [34]. One possible explanation for such a difference may be that positive attitudes towards PA among students were at a high level at baseline. Moreover, no significant increase was observed in the attitudes of the elderly towards walking in the investigation by De meester et al [35]. However, an investigation by Ghazanfari revealed no significant difference between the study groups in terms of emotional attitudes, which was due to the high score for emotional attitude obtained by the individuals at the beginning of the study [9]. The mean for the construct of subjective norms in the intervention and control groups at baseline and follow-up revealed no significant differences. This study just educated participant; using methods such as educational panel discussions and educational sessions for the family members of health volunteers might have a positive impact on the given construct.

Similar to previous reports, [10, 11, 36], the perceived behavioral control was significantly improved in the intervention at follow-up. In fact, the education helped participants feel that they had enough control over their behaviors, and could perform the behaviors under any conditions [37].

Furthermore, the educational program provided for the intervention group increased the behavioral intention at 6-months follow-up. The given results are also in line with the findings from earlier reports [33, 35, 38]. In the investigation by Moeni et al. behavioral intention was considered as the most important factor affecting physical activity among university students [39]. It seems that in the present study, presented educational contents on the advantages of sports and the disadvantages of physical inactivity, discussing strategies to adopting physical behaviors including walking, resulted in improvements in individuals' behavioral intention in terms of physical activity.

The results of this study showed the positive impact of educational program on physical activity behavior in the intervention group. These results were similarly supported in the investigation by De meester et al. [35]. Moreover, the findings on physical activity behavior are in line with the results by Sniehotta et al. [40], but in contrast with the results of Williams et al. on physical activity among outpatients using TPB [8] and

patients with diabetes [41]. This might result from the different characteristics of the populations under study.

The PCI was also employed in the present study as an objective measurement of physical activity which was reduced significantly in the intervention group compared with that in the control group. This result is in line with the findings by Arastoo et al. in terms of the effect of aerobics and yoga exercises on the PCI among patients [31].

## **The Strength Of The Study**

As recommended by CONSORT group, reporting RCTs of social and psychological interventions [42] should provide readers with how and why PA changes for participants (health volunteers in this study). The study makes it possible for a researcher to replicate such an intervention and for health care providers to apply the program.

## **Limitations**

The present study did not assess participants' body mass index in posttest, which is a significant limitation. Second, there was no possibility of observing participants in terms of their physical activity program, and only their self-reports in this respect were included. However, the improved PCI is a valuable objective measure to confirm this issue.

## **Conclusion**

The TPB-directed educational program improved physical activity and physiological cost index. The study framework provided a practical template for interventions aimed at improving physical activity among women. Health authorities can utilize this template as an evidence-based initiative that might close the gap between theory and practice in improving health outcomes.

## **Abbreviations**

PA  
Physical activity  
TPB  
Theory of planned behavior  
PCI  
Physiological Cost Index

## **Declarations**

**Ethics approval and consent to participate**

All participants were informed about the study and confidentiality protocols. Informed written consent was obtained from all the participants. The Ethics Committee of Ahvaz Jundishapur University of Medical Sciences confirmed the morality and ethics of the study (CODE IR.AJUMS.REC.1395.274).

### **Consent for publication**

Not applicable.

### **Availability of data and materials**

Upon request, we can offer onsite access to external researchers to the data analyzed at Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran.

### **Competing interests**

The authors declare that they have no competing interests. The corresponding author of this manuscript (MA) is a member of the editorial board (Associate Editor) of this journal.

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No grant was received for this research.

### **Authors' contributions**

The authors' responsibilities were as follows: MA was the supervisor of the study. MA, KJ, AA and ZGh designed the study, intervention, and questionnaire and also drafted the manuscript. ZGh helped the data analysis and questionnaire development. KJ conducted the study. AM and AH did statistical analysis. All authors contributed to the design and data analysis and assisted in the preparation of the final version of the manuscript. MA provided the final version of the manuscript. All authors approved the final version of the manuscript.

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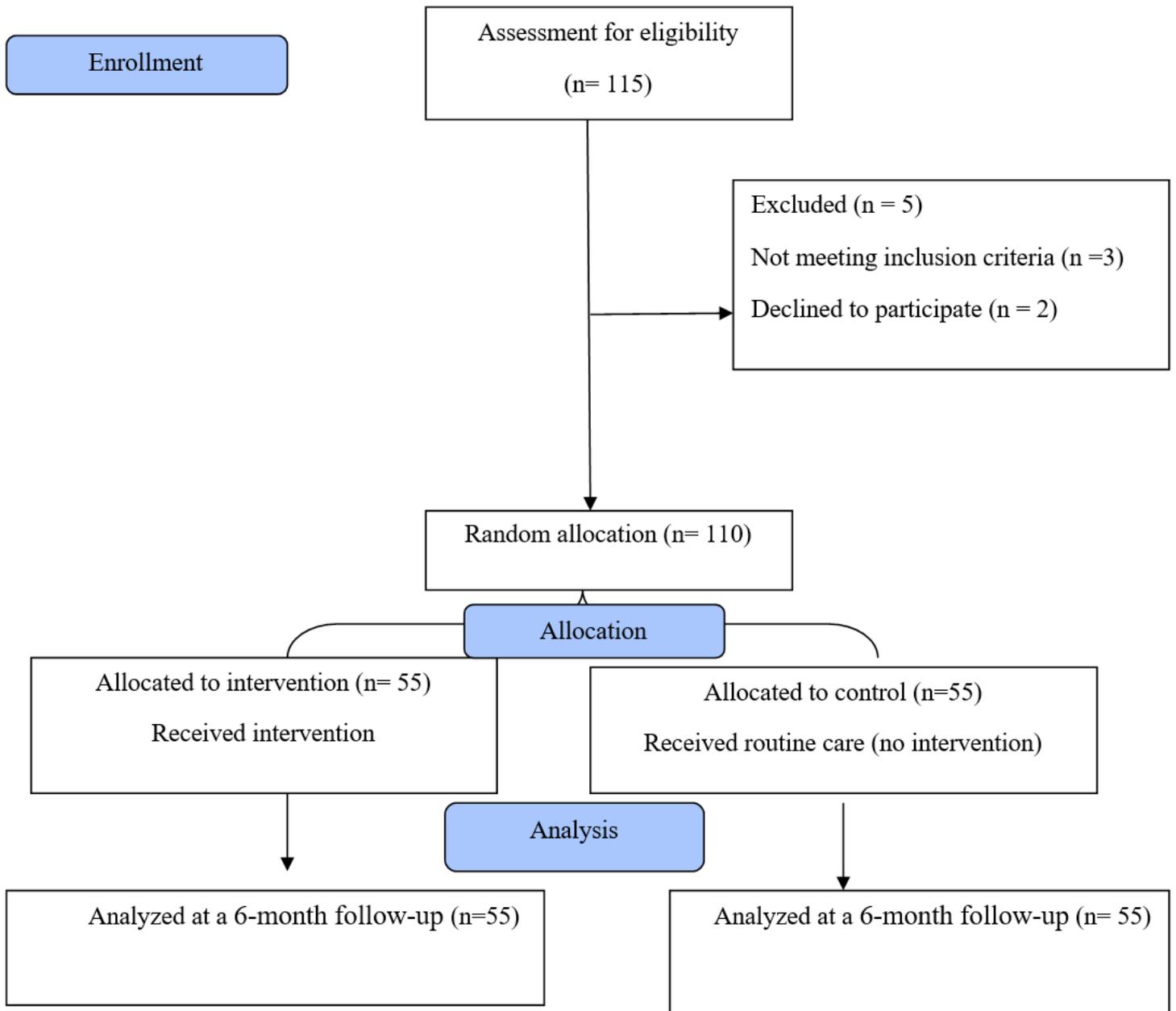
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## Figures



**Figure 1**

Flow diagram of the study

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