Promoting Sustainable Physical Activity Among Iranian Middle-Aged Women: An Interventional Study

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Abstract

Background: The physical inactivity can enhance the risk of adverse health conditions such as non-communicable diseases, morbidity, and mortality among middle- and older-aged population. This study aimed to design, implement, and evaluate a conceptual model of physical activity (PA) promotion among Iranian middle-aged women (IMGW).

Methods: An interventional study with 80 women aged 30-59 years in intervention and control groups was conducted in 2018-2019. The subjects referred to health centers were selected by the available convenience sampling method. The data collection tools including face-to-face interviews, body mass index (BMI) measurements, the four-question form of PA vital signs in the framework of the Iran's Package of Essential Non-communicable (IraPEN) program, and the questionnaire based on Health Belief Model (HBM) constructs were used to assess the IMGW' PA level (metabolic equivalent tasks (MET)-min/week).

Results: The intervention led to a three-fold increase in the average PA (from 280.63 to 927.70 MET-min/week) of the intervention group. Although there was no significant difference in the BMI between both the groups before the intervention, this educational program decreased the mean BMI from 30.36 to 28.83 kg/m^2 (p=0.01). The HBM-based perceived sensitivity/severity and self-efficacy values after the intervention were increased from 62.09 to 71.03% and from 27.01 to 83.15%, respectively (p<0.0001). No significant difference in the cue to action and perceived benefits and barriers after the intervention was found.

Conclusion: The developed model through increasing the motivation of IMGW could remarkably improve the PA level with a decrease in their BMI.

Trial register: Iranian Registry of Clinical Trials (IRCT): IRCT20200717048124N1 at 2020-08-05, retrospectively registered.

Background

Nowadays, the leading causes of morbidity and mortality in the globe are risk factors for developing chronic non-communicable diseases (NCDs) such as cardiovascular diseases (CVDs), overweight, obesity, diabetes, hypertension, and cancers [1]. Lifestyle modification programs using an integration of efficacious interventions namely regular physical activity (PA), proper nutrition, and stress management can significantly decrease the risks associated with modern chronic diseases in the long term [1, 2]. Physical inactivity is increasing rapidly in low- to middle-income countries [2]. This risk factor with considerable variability across different regions worldwide is highly affected by age, gender, health status, self-efficacy (SE), and motivation [3].

Based on the data disseminated by the Word Health Organization, 9% of the world's deaths are attributed to inadequate PA [4]. Also, 21–25% of breast and colon cancers, 27% of diabetes, and 30% of CVDs have

been attributed to regular physical inactivity [5]. CVDs are considered as the most critical consequence of physical inactivity [6]. In 2016, CVDs and stroke caused by a sedentary lifestyle totally cost $315.4 billion for the US healthcare system [7]. Despite the information release about the disadvantages of a sedentary lifestyle, Iranians are in a state of extreme immobility, so that studies show that more than 80% of Iran's population is physically inactive (less than 90 min per week for 3 months) [8]. Since the Iranian people are moving towards aging, it is not far-fetched to predict an increase in the burden of chronic diseases and their risk factors [9]. Besides, it is anticipated that approximately 20% of the worldwide population by 2050 will be women older than 50 years old [10]. According to the Population and Housing Censuses 2016, 8.5 million 40-64-year-old women with very little PA are living in Iran [11].

Using an individually-tailored health behavior change technique as a visible and replicable interventional tool can effectively improve the health status of middle-age people in the society through drawing empirical and theoretical aims, program development, implementation, feedback, and monitoring [12]. These interventions may involve a large number of population groups according to the integration of demographic parameters such as gender, age, marital and parenting status, and socioeconomic situation. In the meantime, achieving an in-depth understanding and acknowledge of the unique properties of participates including values, motivators, preferences, and challenges is essential to develop an efficient intervention for promoting the PA level [13]. Accordingly, designing behavior change programs and promoting PA allow Iranian middle-aged women (IMGW) to understand the impact of their behavior on health and to make decisions about having a healthy life. Therefore, the present study aimed to choose and assess a suitable and indigenous model to promote the PA of IMGW.

Methods

Study design and subjects

An interventional quasi-experimental study for three months between Dec 2018 to April 2019 was performed to promote the PA level among IMAW residing in Tehran. Eighty individuals with a mean age of 30–59 years through the available convenience sampling method were chosen among Iranian women referred to the Health Centers of Shahabadi and Abouzar (Tehran, Iran). Then, all the participants were allocated in two groups of intervention (n = 40) and control (n = 40) by a third party using random number table. The sample size (*n*) was calculated using the following formula (Eq. 1):

$$n = \frac{\left(z_1 - \frac{\alpha}{2} + z1 - \beta\right)^2 \left(\sigma_1^2 + \sigma_2^2\right)}{(\mu_2 - \mu_1)^2} \qquad (1)$$

According to the significance level α = 0.05, (Z_1-$\alpha/_2$) = 1.96, β or type II error = 0.2, power 1-β = 0.90, ((Z_1-$_\beta$) = 1.28, SD_1 = 7.3, SD_2 = 4.8, μ_1 = 2.7, and μ_2 = 7.5, the total sample size was calculated to be 70. Based on the attrition risk of 10%, the sample size to compensate was reached to 40 subjects in each of the control and intervention groups. Only the statistical consultant in this study was blinded.

Inclusion and exclusion criteria

The inclusion criteria for all IMGW were as follows: being into a middle-age group (30–59 years), having a middle-school literacy level or above, having an inactive lifestyle (less than 90 min of moderate-intensity PA (brisk walking, jogging) per week according to the instructions of the PA promotion program of Iran Package of Essential Non-communicable Disease (IraPEN), and completing the consent form to participate in the study. In 2014, IraPEN was developed by the Iranian Ministry of Health and Medical Education to provide universal health coverage such as the prevention and care of NCDs and the delivery of mental health services. This program as part of the national health transformation instruction was mainly developed to control the emerging epidemic of NCDs. The exclusion criteria were limited to having some serious diseases such as CVDs, uncontrolled diabetes and hypertension, as well as chronic kidney disease.

Behavioral change model assessment

A number of behavioral change models, including trans-theoretical model (TTM), precede-proceed model (PPM), health belief model (HBM), beliefs, attitudes, subjective norms and enabling factors (BASNEF) model, and health promotion model (HPM), were considered to evaluate the best PA-promoting model after the literature review and unstructured face-to-face interview with the panel of experts. They included twenty specialists (sports medicine, community medicine, psychiatrists, health education, and genetics) with long-term executive backgrounds in the field of health system management and program directors. Before conducting the interview, the interview purpose and content as well as how to record and collect information were first examined. With open questions, the experts were then asked to comment on the different PA behavior change models, the most important factors hindering PA in IMGW, and possible ways to improve their PA level. The interviewees were completely free to express their views. All the recorded and written data were consequently summarized without any individual judgment. Results of the experts' comments showed that the HBM was the best initial model to improve PA in IMGW. Accordingly, individuals in the intervention group completed the HBM-based questionnaire to find the most important solutions in promoting IMGW' PA. HBM-based questionnaire has been validated in Persian (14). However, only some brochures and routine recommendations of healthcare centers on PA were presented to the control group.

Intervention program: design and implementation

The intervention was both face-to-face and virtual. Face-to-face interventions were fulfilled once a month for 90 days and each time for an hour and a half. Aerobics video tutorial for women with useful knowledge for 80 min was provided to all members of the intervention group in the first face-to-face session. In this DVD, aerobic movements using stretch band, cardio fit ball, and 1–2 kg dumbbells from beginner to advanced were trained to strengthen muscles and keep the body in shape. A social group called “Success” was made by registering all individuals in the intervention group and followed by the virtual intervention for three months. In the first and second months of the intervention, the voice book of "goals! how to get everything you want faster than you ever thought possible" written by Brian Tracy, and the voice file of “unlimited power: the new science of personal achievement” from Anthony Robbins were respectively presented. After highlighting the key points of these books, an algorithm including the

following steps was designed in the intervention group: (i) inspire change and motivate excellence, (ii) decisive decision-making, (iii) write goals clearly, (iv) focus on the goal, and (v) plan to achieve the goal. Finally, the practical program to achieve the goal was implemented based on comprehensive studies of the health system and available resources (Fig. 1). At the end of the third month of the intervention, the level of PA and body mass index (BMI) of IMGW was assessed in the intervention and control group.

Data collection

Demographic and anthropometric measures

The demographic data (e.g., age, marital status, literacy, etc.) of IMGW in both groups were collected through a face-to-face interview. The participates' height was determined without shoes in a standing position by a stadiometer to the nearest 0.5 cm, whereas the shoulders were in a normal state. The body weight of IMGW with wearing light clothes and no shoes or socks was measured and recorded using a SECA 768611 balance scale (Seca™, Seca Vogel & Halke GmbH & Co., Hamburg, Germany) with an accuracy of 0.1 kg. The BMI was calculated by dividing the weight (in Kg) to the square of measured height (in m).

IraPEN-based assessment of physical activity

All the participants completed a four-question form of PA vital sign according to the IraPEN instruction. In this checklist, the median (slow running or brisk walking) and intense (brisk running or brisk walking) PA levels within a week are asked. This parameter is expressed in metabolic equivalent tasks (MET)-min/week. One MET is usually considered to be 3.5 mL/min/kg resting oxygen consumption. The weekly total PA is obtained from the daily sum of the average (600–1500 MET-min/week) and vigorous (> 1500 MET-min/week) PA amounts during a week. According to the IraPEN guidelines, adults with a standard PA do at least 150 min of moderate-intensity aerobic PA or do at least 75 min of vigorous-intensity aerobic PA throughout the week. A person is considered sedentary if her/his PA with moderate intensity is less than 90 min.

Health Belief Model (HBM) questionnaire-based data

The HBM questionnaire including 96 items was completed by IMGW assigned to the intervention group, based on six constituent constructs including perceived sensitivity (PSS) and perceived severity (PSV) (17 items), cue to action (CA, 15 items), perceived benefits (PBF) and perceived barriers (PBR) (54 items), as well as SE (10 items). A four-point Likert scale was used for most items (PSS, PSV, PBR, and CA) with a score range of 1 (disagree strongly) to 4 (agree strongly). Also, a five-point Likert scale was employed for the SE sub-group, ranging from 1 “not confident at all” to 5 “very confident”. Based on the items available in PSS and PSV sub-groups, the minimum and maximum scores are 17 and 68, respectively, while the PBF and PBR have a maximum score of 216 and a minimum score of 54. According to the Likert scale ranges and the number of items in the questionnaire, the lowest and highest scores for CA and SE are 15 and 60, as well as 10 and 50, respectively [14]. The Cronbach’s alpha coefficient (CAC) was used to

assess internal consistency reliability of the HBM questionnaire. A high reliability was recognized by estimating CACs of 0.72–0.85 for the different constructs. The content validity was determined using10 experts in the areas of community health and medicine.

Statistical analysis

In the descriptive analysis, a mean of the obtained values with the standard deviation (SD) for normally distributed continuous data was presented. Fisher's exact and independent-samples *t*-tests for categorical and continuous variables were respectively used to compare the control and intervention groups. The Statistical Package for Social Sciences, version 22.0 (SPSS Inc., Chicago, IL, USA) was applied to analyze the data at a significant statistical level of $p < 0.05$.

Results

Table 1 shows some demographic characteristics of IMGW in the control and intervention groups. There was no loss in any group in this study. The age of participants in control and intervention groups was 41.5 and 41.4 years, respectively. Most individuals in both groups were married with an educational level of diploma and above (Table 1). There were not significant differences in age ($p = 0.9$), as well as marital and educational status ($p = 0.3$) between two groups of control and intervention. Therefore, the two groups were homogeneous in terms of investigated demographic characteristics.

Table 1
Some demographic data of IMGW in the control and intervention groups

Demographic characteristics	**Control group (n = 40)**	**Intervention group (n = 40)**	**p-value**
Age (years old)	41.50 ± 7.85	41.40 ± 7.54	0.90
Marital status [n (%)]			
Married	39 (97.5)	37 (92.5)	0.61
Single/Separated	1 (2.5)	3 (7.5)	
Education level [n (%)]			0.30
Under diploma	12 (30.0)	13 (32.5)	
Diploma and above	28 (70.0)	27 (67.5)	

The data collected from HBM questionnaire before the intervention were statistically analyzed to determine that the intervened individuals have the most difficulty with which the HBM-based constituent construct. The lowest and highest scores obtained by the intervened IMGW were related to the SE (27.01) and CA (81.30), respectively (Table 2). Therefore, the HBM in this IMGW group will be effective on their SE. Accordingly, the most important problems of the members were the low SE and lack of motivation, which were considered in the design of the main model. Table 2 reveals that the PSS-PSV and SE scores

significantly increased from 62.09 to 71.03 and from 27.01 to 83.15 by implementing the intervention in 90 days, respectively ($p < 0.0001$). However, no significant increase in scores of CA and PBF-PBR was found (Table 2).

Table 2
The HBM scores of IMGW in the intervention group before and after the PA promoting intervention

HBM constructs†	Total score	Intervention program ‡		Significance level (p-value)
		Before	After	
PSS-PSV	66.73 ± 11.00	62.09 ± 6.03 [b]	71.03 ± 12.76 [a]	< 0.0001
CA	81.91 ± 4.99	81.30 ± 4.49	82.48 ± 5.42	0.57
PBF-PBR	70.33 ± 1.00	68.92 ± 8.96	71.63 ± 1.09	0.30
SE	55.08 ± 3.10	27.01 ± 6.86 [b]	83.15 ± 1.68 [a]	< 0.0001

† HBM: Health belief model, PSS: perceived sensitivity, PSV: perceived severity, CA: cue to action, PBF: perceived benefits, PBR: perceived barriers, SE: self-efficacy

‡ a, and b, are significant statistical letters.

Before the intervention program, there was no significant difference in BMI values between control and intervention groups ($p = 0.1$). Although no significant difference in BMI of the control group was observed, the BMI value of the intervention group was significantly reduced from 30.36 to 28.83 kg/m^2 (Fig. 2a). Therefore, the reduced BMI (1.52 kg/m^2) in intervened women compared to the control after the HBM program was significant ($p = 0.01$). Moreover, there was no significant difference in the PA level between the both groups before the intervention implementation ($p = 0.8$). Figure 2b depicts that the PA level in the intervened group was remarkably increased from 280.63 to 927.70 MET-min/week ($p < 0.001$). However, the increase of PA level in the control group from 275.62 to 308.75 MET-min/week was non-significant. Thus, an increase of more than threefold was recorded in this group after the intervention (647.07 MET-min/week), while this increase in the control group only was 33.13 MET-min/week. Consequently, the PA increase in the intervention group was significantly higher than the control group ($p < 0.001$).

Discussion

The PA level of women at older ages usually is lower compared to men. PA-related behavioral changes in women are typically occur at the time of menopause and beyond. This insufficient physical activity is the main cause of epidemics of many serious diseases such as cardiovascular, respiratory, musculoskeletal, and metabolic diseases [2, 4, 9]. Thus, there is a necessity to design appropriate behavioral models to change the PA pattern in women of this age group. After reviewing the literature about the efficient

behavioral change models, the HBM was chosen as the appropriate initial model to improve the PA in IMAW. This model is a relatively short-term intervention in the prevention programs. People in this practical model should initially feel threatened by increased risk of BMI and chronic diseases (PSS) and subsequently perceive the risk severity and the significance of its various related-complications on physico-mental and socio-economic aspects (PSV). After that, individuals would be able to observe optimistic signs received from their surroundings (CA), and believe in the helpfulness and efficiency of the designed prevention programs (PBF) with the low obstacles to behavior change [15, 16]. The assessment of the HBM components before and after the intervention implementation showed that there was no significant difference in CA and PBF-PBR, while the PSS-PSV and SE changed significantly. These results were consistent with studies in which educational interventions led to increased awareness of regular physical activity [17–19].

Results showed that the PA level with a reduced BMI could be fulfilled by increasing the motivation and SE in IMAW. The effectiveness of a 9-month virtual training in terms of a web- and mobile phone-based intervention on the PA improvement in Australian middle-aged males was earlier reported by Duncan et al. [20]. These researchers also emphasized that virtual training should be given priority over paper training due to the high availability and increasing use of mobile phones and social networks [20]. In a meta-analysis study, the role of interventional training in increasing the PA level of more than 22,500 adults with chronic diseases was examined. Results showed that the average PA in the intervention group was higher than in the control group (48 min of PA per week or 945 steps per day). In most studies, there was no correlation between PA levels and people's age, sex, as well as socio-economic status. However, factors such as the design of regular programs, continuous monitoring, taking into account job conditions, and adequate available time played the most important role in the steady implementation of the PA-promoting program [21]. The study of Janssen et al. [22] on 90 American MAW stratified by level of PA over 15 years showed that those with consistent PA had higher autonomous motivation and SE. Also, 61% of these people tend to make friends with highly active individuals. In a workplace setting, Ribeiro et al. [23] designed a 3-month interventional study of aerobic training and pedometer-based individual/group counseling to increase the PA level accompanied by the decreased anthropometric factors in Brazilian MAW. They realized that the pedometer-based counseling could effectively increase the daily life number of steps, while aerobic training was able to reduce and to reduce their bodyweight loss. A significant improvement in the PA level of American MAW with obesity and high inactivity in a short-term period of three months was also reported using the interventionist-led intervention because of the increased individual’s motivation for lifestyle changes [24].

Conclusion

In this study, the lack of motivation after reviewing the literature and interviews with experts was identified as one of the most important factors of inactivity in IMAW. An educational intervention to increase the motivation level was developed by designing a model of promoting women's PA in this age group. The designed model resulted in a significant increase in the PA level and a decrease in BMI. Despite the difficulty of PA increase in IMAW, this healthy lifestyle approach in the short-term period of

three months was well achievable by increasing motivation and emphasizing on fitness, beauty, and attractiveness following ongoing PA in this population group. In general, a permanent behavior change cannot be made without constantly reinforcing it. Therefore, positive behavioral changes occurred in individuals should be encouraged and reinforced in the short term (once a week to once a month) to long term (once every 6 months to once a year). Accordingly, the present study has some limitations so that it has not been followed for longer than three months. Inactivity like chronic diseases is multifactorial and needs follow-up. It is recommended to simultaneously implement social interventions such as increasing the number of women's parks, clubs, available exercise environments to improve the level of IMAW's-PA. Since one of the limitations of the present study was air pollution in Tehran, an efficient alternative will be the use of indoor exercise environments, with controlled and invariable conditions, for training in bustling or quiet fitness space. Lastly, a motivational follow-up system in health plan design should be implemented for the surveillance of IMAW's-PA through health care providers or online systems.

Abbreviations

BASNEF
beliefs, attitudes, subjective norms and enabling factors, BMI:body mass index, CA:cue to action, CAC:Cronbach's alpha coefficient, CVDs:cardiovascular diseases, HBM:health belief model, HPM:health promotion model, IMGW:Iranian middle-aged women, IraPEN:Iran package of essential non-communicable disease, PA:physical activity, PPM:precede-proceed model, MET:metabolic equivalent tasks, NCDs:non-communicable diseases, PBF:perceived benefit, PBR:perceived barriers, PSS:perceived sensitivity, PSV:perceived severity, SE:self-efficacy, TTM:trans-theoretical model

Declarations

Ethics approval and consent to participate: The performed study's protocol was following the principles of the declaration of Helsinki and the Nuremberg Code and approved by the Ethics Committee of Tehran University of Medical Sciences. The project approval number is IR.TUMS.MEDICINE.REC.1396.3662. An oral and written informed consent was obtained for each participants in this study.

Consent to publication: Not applicable

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests: Mohammad Shariati, Houra Pourrajabali Astaneh, Leila Khedmat, Farnaz Khatami declare that they have no competing interests

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Figures

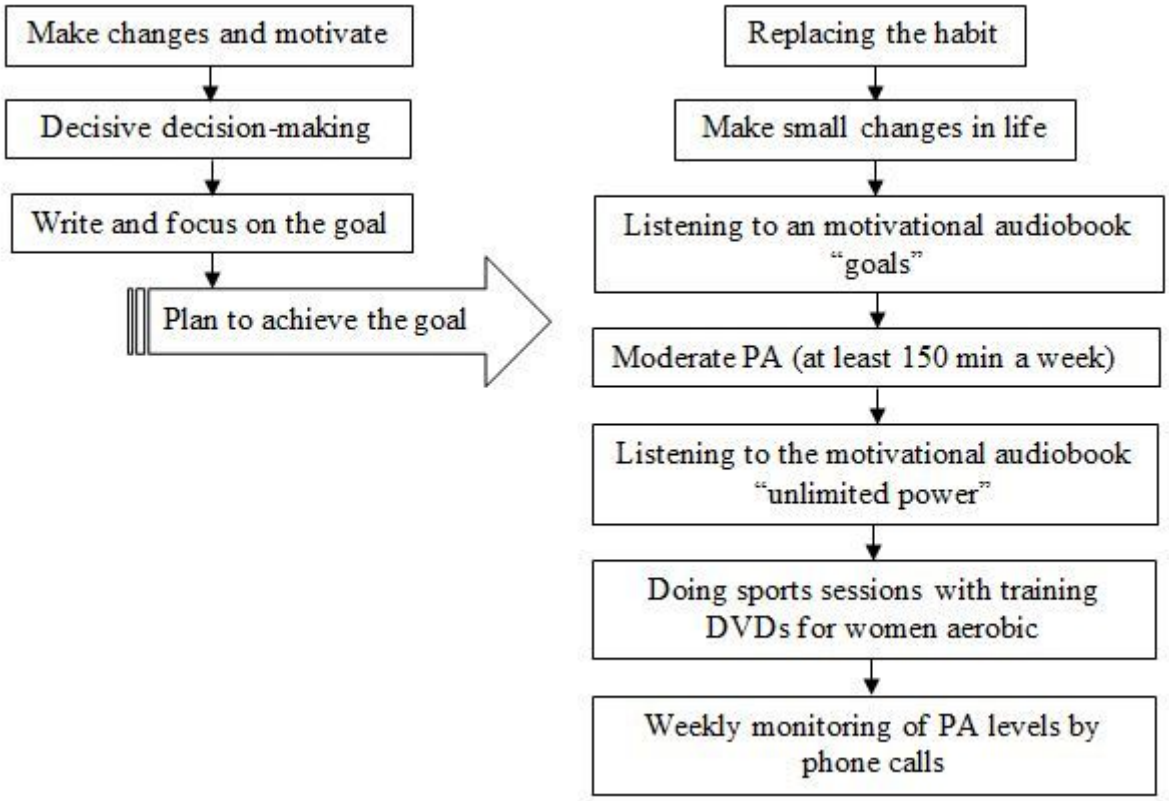

Figure 1

A developed pre-instruction to promote the PA level in IMGW based on the IraPEN and HBM integration

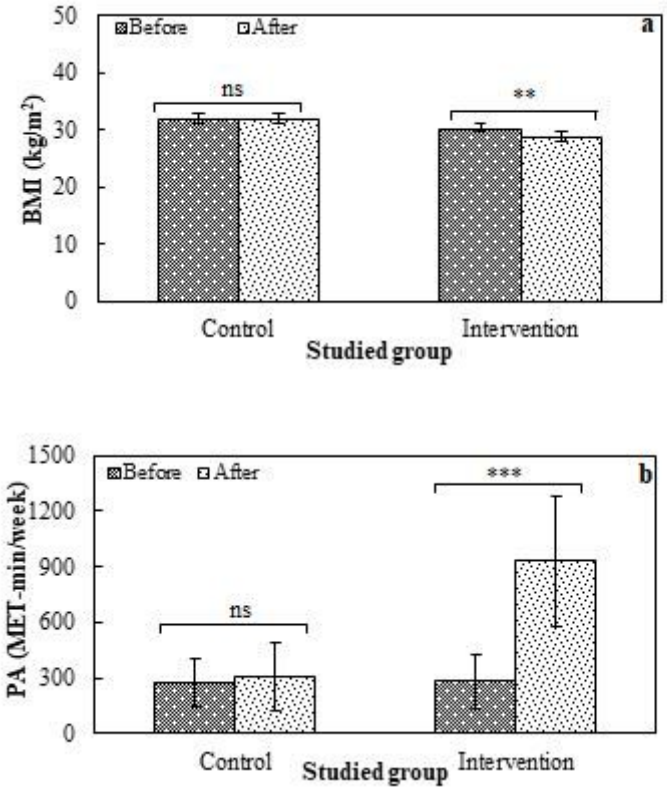

Figure 2

The BMI (a) and PA (b) levels of IMGW in the control and intervention groups before and after the health promoting program (ns: non-significant, ** and *** are significant at p-values of <0.01 and <0.001, respectively).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- CONSORT2010Checklist.doc