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Program Based on Risk Perception Theories for the Prevention of Common Non-Communicable Disease

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Authors
Alizadeh N.[1] *MSc*
Shojaeizadeh D.*[1] *PhD*
Jalili Z.[1] *PhD*
Jahangiry L.[2] *PhD*

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[1]Health Education and Promotion Group, Science and Research Branch, Islamic Azad University, Tehran, Iran
[2]Tabriz Health Services Management Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

Correspondence
Address: Health Education and Promotion Group, Science and Research Branch, Islamic Azad University, University Square, Shahadai Hesarak Boulevard, Tehran, Iran. Postal Code: 1477893855
Phone: +98 (21) 44869578
Fax: +98 (21) 44869578
shojae5@yahoo.com

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ABSTRACT

Aims This study was designed to evaluate the impact of an educational intervention grounded in risk perception theories aimed at the prevention and management of common non-communicable diseases in an urban population.

Materials & Methods The study employed a semi-experimental design with two groups (intervention and control), utilizing a pre- and post-test approach. It incorporated protection motivation theory and the health belief model within an urban population in Hashtruod, focusing on non-communicable disease prevention and care in 2023. The participant population consisted of 426 individuals, with 213 assigned to the intervention group and 213 to the control group, all randomly selected from the comprehensive health centers in Hashtrood. A questionnaire assessing personal risk perception regarding non-communicable diseases was used, which included five dimensions: Perceived sensitivity, perceived barriers, perceived benefits, perceived self-efficacy, and behavioral intentions to change. The educational intervention, designed to enhance personal risk perception, was implemented over two sessions within a two-week period for the intervention group.

Findings The intervention based on risk perception theories significantly improved the intervention group's perceived sensitivity, perceived severity, perceived benefits, self-efficacy, and guidance for action.

Conclusion An educational intervention based on the health belief model and protection motivation theory effectively enhanced awareness constructs, behavioral intentions, perceived sensitivity, perceived severity, perceived benefits, perceived barriers, self-efficacy, response self-efficacy, and guidance for adopting healthy behaviors.

Keywords Non-Communicable Diseases; Risk; Motivation; Early Intervention

CITATION LINKS

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Introduction

Noncommunicable diseases (NCDs) are the leading cause of death and morbidity worldwide [1]. They are recognized as one of the greatest health challenges of the 21st century and include diseases such as diabetes, cardiovascular disease, cancer, and chronic respiratory diseases [2]. In recent years, the spread of non-communicable diseases (NCDs) has become one of the greatest public health concerns worldwide and is recognized as the leading cause of death in most countries in the world. According to the World Health Organization, noncommunicable diseases are responsible for more than 70% of global deaths [2]. In recent years, the prevalence of NCDs in Iran has notably increased. The rates of NCDs and injuries in Iran are higher than the global average and exceed those of countries with medium to high socioeconomic status. Alarmingly, risk factors associated with NCDs are now impacting younger populations, contributing to various health inequalities within communities [3]. Reducing NCDs' burden and associated mortality remains a core goal for countries [4, 5].

However, a substantial portion of the population, particularly in urban areas, lacks adequate access to healthcare services related to noncommunicable diseases [6]. A key issue facing health systems is the utilization of healthcare services, which is crucial for facilitating social activities and promoting equal opportunities within society [7]. Given the shift in population ratios (where urban populations are increasingly outnumbering rural ones [8]) ensuring the health of urban residents has become highly important [9]. Urban populations, with relatively higher levels of noncommunicable diseases, poorer health outcomes, and poorer access to health care, are potential bridges for gaps in access to health care [10]. In a situation where the ratio of urban to rural population in the world and Iran is changing in favor of the urban population and the urban population is increasing day by day [7], a large part of the population, especially the urban population, does not receive health care services, mainly related to noncommunicable diseases [5].

Risk factors for noncommunicable diseases are usually divided into two categories; Non-modifiable risk factors (including age, sex, and family history), and modifiable risk factors (including poor nutrition, physical inactivity, tobacco and alcohol use, and stress). Studies show that 70% of noncommunicable diseases are associated with modifiable risk factors [2]. Research has shown that increasing public awareness of the risk factors and consequences of NCDs can help reduce their prevalence. Therefore, a deep understanding of these NCDs and their associated risks will not only help improve individual health but will also have a positive impact on reducing the financial burden on health systems [11]. Understanding the risk of these diseases and their associated factors can play an effective role in the prevention and management of these diseases and is of particular importance in adopting preventive behaviors [12]. Resistance to accessing these services often stems from financial and cultural constraints, compounded by a lack of available services, trained professionals, inadequate public transportation, and insufficient information [13, 14].

To date, there has not been a comprehensive study examining educational interventions based on risk perception theories aimed at preventing the four most common noncommunicable diseases in Iran. Therefore, this study aims to design, implement, and evaluate an effective educational intervention to enhance the receipt of NCD prevention and care services. The results of this intervention are intended to help identify both weaknesses and strengths in the health services provided, offering valuable insights for officials and policymakers as they plan for the optimal use of these services.

Materials and Methods

An educational intervention was conducted in 2023, utilizing a random sampling method at comprehensive urban health service centers in Hashtruod City. The population for this semi-experimental study consisted of 426 individuals, with 213 participants in the intervention group and 213 in the control group, all selected from patients registered with the SIB system to receive services. Selection of intervention and control group individuals: The health care provider was asked to list individuals over 30 years of age at the comprehensive health center, regardless of age, gender, presence or absence of disease, history of visiting the center, and receipt or non-receipt of services, which was equal to 6950 individuals. Then, using online randomization software, 426 individuals were randomly selected. And in the next stage, 426 people were selected using the software

(block identifier, block size, sequence within block, treatment, code) randomly divided into A, B, A, B, B, A 2 ... into intervention group (A) and control (B) of 213 people. This population included both healthy individuals and those with non-communicable diseases, such as cardiovascular disease, cancer, diabetes, and hypertension (Figure 1).

Data collection was performed using a structured questionnaire that included demographic parameters as well as measures of perceived vulnerability, severity, benefits, barriers, action guidelines, behavior, self-efficacy, and response efficiency. Specifically, the risk perception and prevention questionnaires for non-communicable diseases were employed [15, 16]. The personal risk perceptions in noncommunicable diseases questionnaire assesses risk perception related to four major non-communicable diseases and consists of five dimensions; Perceived susceptibility,

perceived barriers, perceived benefits, perceived self-efficacy, and behavioral intention to change. Perceived susceptibility was evaluated through four questions based on the NCD-PR5-21 framework, with responses scored on a four-point scale ranging from "strongly disagree" to "strongly agree". The total score for perceived susceptibility could range from a minimum of 4 to a maximum of 16, indicating varying levels of perceived risk for non-communicable diseases. Perceived severity was assessed using five questions with the same four-point response format, yielding scores ranging from 5 to 20. Self-efficacy was evaluated with another set of five questions, also using a four-point scale, and scored similarly. Behavioral change intention, perceived benefits, and perceived barriers were assessed with five questions each, while perceived barriers were measured through three questions, utilizing the same scoring system. Data collection was conducted face-to-face at comprehensive health centers. To ensure the validity and reliability of the questionnaire, quantitative assessments were performed using the Content Validity Ratio (CVR) and Content Validity Index (CVI). A panel of ten experts in health education and epidemiology reviewed the items for relevance and adequacy, resulting in significant CVR and CVI scores for the self-efficacy questions (CVR=93.00, CVI=90.00). Reliability was evaluated through a test-retest approach, demonstrating Cronbach's alpha coefficients ranging from 0.77 to 0.90 across different domains, reflecting strong internal consistency. The questionnaire was completed by 426 individuals, including 213 from the intervention group and 213 from the control group. For those who visited health centers, the questionnaires were completed in person, while participants who did not visit were contacted by phone using the numbers registered in the SIB system.

The educational intervention was planned and carried out over two days, comprising four educational sessions, each lasting two hours (Table 1). In this study, SPSS version 23 software was utilized for data analysis. Descriptive statistics were employed to summarize the data, using means and standard deviations for quantitative data, and counts and percentages with a 95% confidence interval for qualitative data. The normality of the distribution of quantitative parameters was assessed using the Shapiro-Wilk test. To compare the data of the two groups at the beginning of the study, as well as to analyze the changes between the two groups at the end of the study, the Covariance test was applied.

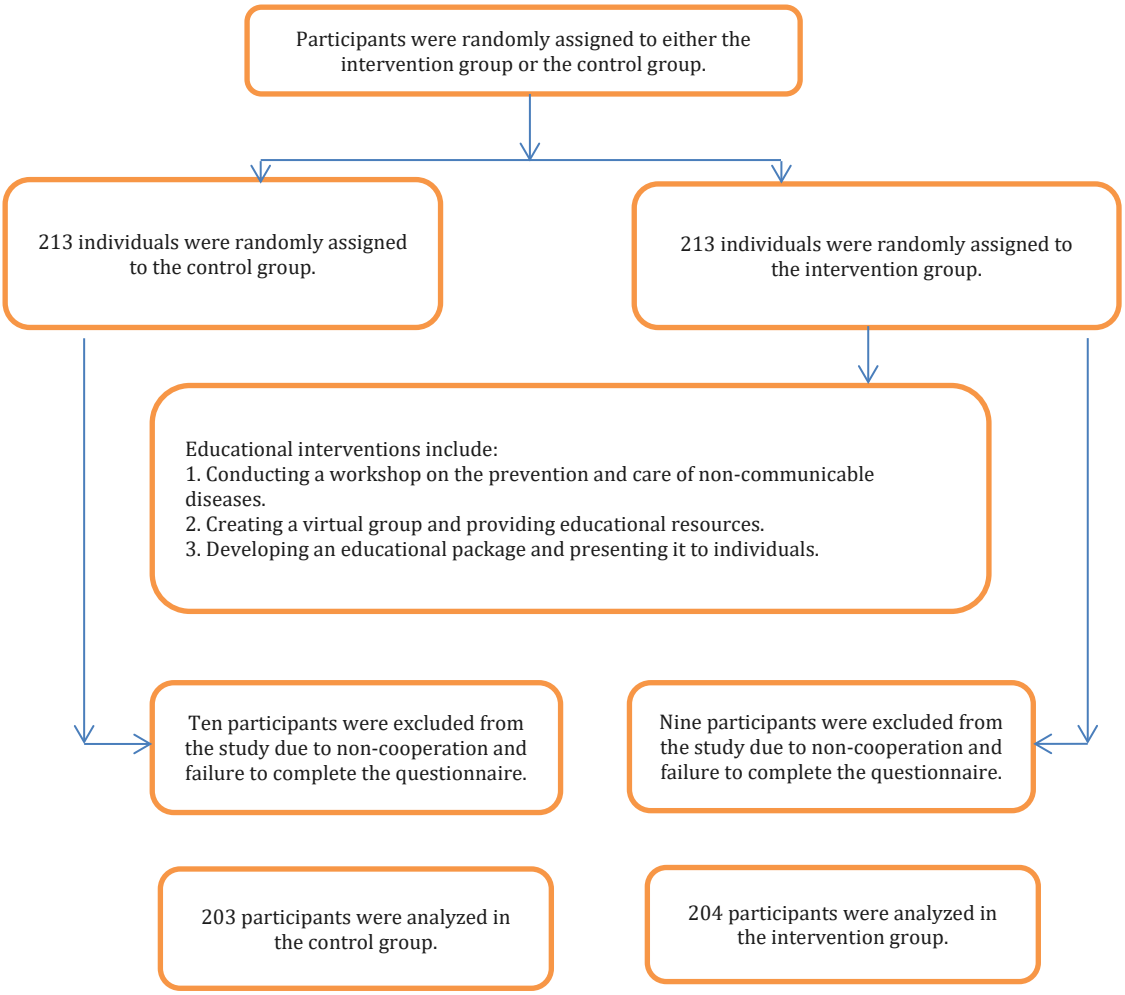

Figure 1. Study flowchart

Table 1. Contents and objectives of each session based on the constructs of the Health Belief Model and Protection Motivation Theory

Session	Title
First day, Session 1: **Overall objective: To enhance awareness, sensitivity, perceived severity, benefits, and barriers in non-communicable disease prevention and care.**	Partial objective: By the end of the session, participants will: - Gain familiarity with non-communicable diseases and their complications. - Be able to compare and evaluate the benefits and drawbacks of preventing and managing non-communicable diseases. During this session, learners were introduced to the care of non-communicable diseases. By watching educational videos, they became aware of the complications and effects of these diseases on the body, as well as their physical, psychological, and social implications for future life. Participants also engaged in discussions about the benefits and disadvantages of preventing and managing diabetes, allowing them to draw informed conclusions about the importance of prevention and care.
Day 2, Session 2: **Overall objective: Enhance self-efficacy, respond to self-efficacy, provide guidance for action, and improve behavioral intention regarding the prevention and care of non-communicable diseases. Effective strategies for prevention and care through group discussions, which contributed to their empowerment against non-communicable diseases. The session included a review of essential behaviors for preventing and managing these diseases, along with guidelines for action. Additionally, short-term goals were established, and group discussions were conducted to further enhance self-efficacy and perceived self-efficacy responses.**	Partial objective: After the session, learners will: - Enhance their self-efficacy and perceived self-efficacy responses. - Practice behaviors related to the prevention and care of non-communicable diseases. - Accept case studies and tips as guides for action. In this session, learners improved their self-efficacy by watching an educational video and using the experiences of individuals who have successfully prevented and managed non-communicable diseases (vicarious experience). They also learned effective strategies for prevention and care through group discussions, which contributed to their empowerment against non-communicable diseases. The session included a review of essential behaviors for preventing and managing these diseases, along with guidelines for action. Additionally, short-term goals were established, and group discussions were conducted to further enhance self-efficacy and perceived self-efficacy responses.

Findings

There were no significant differences in the demographic characteristics between the intervention group and the control group. The mean age in the intervention group was 55.5 years, while in the control group, it was 54.9 years. A comparison of personal and social characteristics showed no significant differences in gender distribution between the two groups. An analysis of educational background revealed no significant differences in educational attainment between the intervention and control groups. Regarding marital status, there were no significant differences between the two groups. Additionally, there was no significant difference in the history of non-communicable diseases between the intervention and control groups. In the intervention group, 28.2% of participants had a non-communicable disease, while 71.8% did not. In the control group, 26.02% had a non-communicable disease, and 73.08% did not (Table 2).

Table 2. Demographic characteristics

Characteristics	Intervention (n=204) Frequency (%)	Control (n=203) Frequency (%)	P
Sex			
Man	104 (48.8)	1.6 (49.7)	0.241
Woman	109 (51.2)	107 (50.3)	
Education			
Elementary	102 (47.7)	100 (47)	
Diploma	74 (35.1)	73 (34.2)	0.363
University	37 (17.2)	40 (18.8)	
Marital status			
Singel	35 (16.4)	32 (15.02)	0.858
Married	178 (83.6)	181 (84.7)	
Does the individual have a history of non-communicable diseases?			
Yes	60 (28.2)	56 (26.2)	0.611
No	153 (71.8)	157 (73.8)	
Referral for services			
Yes	119 (55.8)	115 (54)	0.796
No	94 (44.2)	98 (46)	

There was no significant difference in the referral rates for non-communicable disease services between the intervention and control groups. In the intervention group, 55.8% of participants were referred to receive services, while 44.2% did not seek referrals to comprehensive health centers. In the control group, 54% were referred for services, and 46% did not seek referrals.

Educational intervention based on risk perception theories was assessed for both the intervention and control groups, both before and after the intervention (Table 3).

Data analysis showed that: The average perceived sensitivity in the intervention group increased significantly by 4.5 units, whereas the change in the control group was only 0.29 units. At the beginning of the study, the perceived severity levels in both groups were not significantly different. However, the average perceived severity in the intervention group rose significantly by 4.69 units following the intervention, while the control group experienced an increase of only 0.34 units. Similarly, the mean behavioral intention did not differ significantly between the two groups at the study's start. Nevertheless, the mean behavioral intention in the intervention group increased significantly by 1.6 units after the intervention, whereas the control group saw a minimal increase of 0.1 units. The perceived benefits were also similar at the beginning of the study; After the intervention, the intervention group showed a significant increase in perceived benefits by 1.8 units, compared to just 0.1 units in the control group. In terms of perceived barriers, both groups had similar levels at the start of the study. However, the intervention group showed a significant increase in perceived barriers by 1.3 units after the intervention, with the control group seeing no substantial change at 0.1 units. Self-efficacy levels

were also comparable at the beginning of the study. Following the intervention, the intervention group experienced a significant increase in self-efficacy by 1.2 units, while the control group had a modest increase of 0.1 units. The perceived self-efficacy response was not significantly different in either group at the beginning; However, the intervention group showed a noteworthy increase of 1.7 units thereafter, compared to just 0.1 units in the control group. Finally, the average guide to action did not significantly differ between the two groups before the intervention.

After the intervention, the guide to action in the intervention group increased significantly by 1.9 units, whereas the control group only recorded a change of 0.1 units.

The authors obtained ethical approval from the Ethics Committee and the Vice Chancellor for Research at the Islamic Azad University, Science and Research Branch. The authors introduced themselves to the study participants, explained the study's goals and significance, and requested their cooperation.

Table 3. Comparison of constructs in two groups (Awareness and behavioral intention, perceived sensitivity and severity, perceived benefits and barriers, self-efficacy and self-efficacy response, and guidance for action)

Variables	Before intervention Mean±standard deviation	After intervention Mean±standard deviation	P	Average change
Knowledge/Awareness				
Intervention group	12.20±2.70	15.10±0.30	0.001	2.90±2.40
Control group	12.03±2.70	11.80±2.60	0.261	0.30±0.50
Behavioral intention				
Intervention group	3.10±0.20	4.70±0.70	0.001	1.60±0.50
Control group	3.30±0.60	3.40±0.60	0.186	0.10±0.60
Perceived sensitivity				
Intervention group	11.68±2.12	16.19±1.75	0.001	4.50±2.49
Control group	12.65±2.35	12.94±2.35	0.001	1.23±0.29
Perceived severity				
Intervention group	25.86±3.49	30.55±2.51	0.001	4.68±0.27
Control group	25.15±3.11	25.49±2.96	0.340	0.34±0.15
Perceived benefits				
Intervention group	3.10±1.70	4.90±1.00	0.001	1.80±1.20
Control group	3.20±1.60	3.10±1.60	0.082	0.10±1.50
Perceived barriers				
Intervention group	3.10±1.90	1.80±1.30	0.001	1.30±1.50
Control group	3.10±1.70	3.20±1.80	0.289	0.10±1.70
Self-efficacy				
Intervention group	3.10±1.60	4.30±1.00	0.001	1.20±1.20
Control group	3.30±1.70	3.20±1.70	0.072	0.10±1.50
Self-efficacy response				
Intervention group	3.00±1.80	4.70±1.40	0.001	1.70±1.50
Control group	3.20±1.70	3.30±1.80	0.289	0.10±1.70
Guide to action				
Intervention group	3.00±1.40	4.90±1.20	0.001	1.90±1.50
Control group	3.10±1.60	3.20±1.60	0.215	0.10±1.60

Discussion

This study aimed to Investigate the effect of an educational intervention program based on the health belief model and protection motivation theory on the perception of the risk of non-communicable diseases. Understanding the risks associated with noncommunicable diseases is crucial for their prevention and control [17, 18]. Studies indicate that a lack of adequate risk perception regarding these diseases can lead to a higher prevalence and a significant financial burden on health systems. Research suggests that public education and increased awareness can enhance health behaviors, improve risk perception, and ultimately reduce the risk of noncommunicable diseases [1].

Srithongklang *et al.* in their study successfully enhanced awareness of non-communicable diseases and encouraged individuals to adopt preventive behaviors. The results of their study align with our own findings, which demonstrated that educational interventions can increase behavioral intentions related to the prevention and management of non-communicable diseases [19]. Similarly, the study by Safajou *et al.* indicates that enhancing knowledge and behavioral intentions through educational interventions leads to the adoption of preventive behaviors concerning diabetes among individuals. This finding is consistent with the results of the present study, reinforcing the importance of educational initiatives in promoting health awareness and preventive actions [20].

A study by Sharifi *et al.* examines interventions aimed at preventing fatty liver disease [21], while another study by Dashti *et al.* focuses on improving protective nutritional behaviors [22]. Both studies have found out that educational interventions, which enhance knowledge and behavioral intentions, can effectively promote the prevention and management of noncommunicable diseases. Additionally, Heine *et al.* have conducted a systematic review and meta-analysis to investigate health education interventions designed to improve health literacy among adults

with noncommunicable diseases in low- to middle-income countries. Their findings emphasize that health illiteracy is a significant factor contributing to noncommunicable diseases, particularly in environments where health illiteracy perpetuates various risk factors. The study suggests that interventions promoting health literacy could be crucial tools for both the primary and secondary prevention of noncommunicable diseases [23]. The results provide strong evidence, especially for diabetes patients, indicating that health literacy interventions can enhance knowledge, attitudes, and disease management behaviors across four chronic diseases that contribute to the overall burden of noncommunicable diseases [24].

This study aimed to compare perceived sensitivity and severity in the intervention and control groups before and after the intervention. The findings showed that the mean perceived sensitivity in the control group was higher at the beginning of the study than in the intervention group. However, after the intervention, the perceived sensitivity in the intervention group increased significantly, while the change in the control group was not significant. In terms of perceived severity, there was no significant difference between the two groups at the beginning of the study. After the intervention, the mean perceived severity in the intervention group increased significantly, while this change was insignificant in the control group. Various studies have shown that higher perceived sensitivity to a behavior increases the likelihood of an individual developing a disease and leads them to take steps to avoid the behavior or make positive behavioral changes [25, 26]. Similarly, perceived severity affects an individual's perception of how serious a health threat or harmful condition may be, taking into account physical, psychological, and social symptoms and effects [27, 28]. Numerous studies indicate that perceived sensitivity and severity are the key predictors of whether individuals engage in specific behaviors [27, 28].

A recent study expresses that implementing an educational intervention to enhance these perceived constructs can significantly predict participation in non-communicable disease prevention and care behaviors. For instance, Babaei *et al.* evaluate an educational intervention based on the Health Belief Model. Their findings demonstrate that by improving perceptions of sensitivity and severity, the intervention successfully enhance healthy lifestyle practices and helped prevent cardiovascular diseases [29].

Similarly, Safajou *et al.* assess the impact of an educational intervention on diabetes preventive behaviors, also grounded in the Health Belief Model. Their study shows that the educational intervention effectively improved participants' perceptions of sensitivity and severity, leading to better engagement in diabetes prevention and care behaviors [20].

In a study conducted in 2017, Srithongklang *et al.* demonstrate that implementing an educational intervention can enhance cancer prevention and care behaviors by improving individuals' perceptions of sensitivity and severity regarding the disease [19]. The findings suggest that educational interventions grounded in theories of risk perception and fear can effectively increase people's awareness of their susceptibility to cancer, thereby encouraging greater utilization of noncommunicable disease prevention and care services.

In a study it is expressed that perceived benefits are higher in the control group at the start of the intervention than in the intervention group. However, after the intervention, perceived benefits increase significantly in the intervention group. In contrast, these changes are not statistically significant in the control group. Before the intervention, perceived barriers are similar in both groups. However, after the intervention, the intervention group experience a significant decrease in perceived barriers, while the control group also shows minimal change, which is not significant. Previous studies have shown that the perceived benefits of engaging in a behavior are key predictors of that behavior [30]. At the beginning of the study, the mean self-efficacy in the control group was higher than in the intervention group. After the intervention, self-efficacy in the intervention group increased significantly, while this change was insignificant in the control group. At baseline, there was no significant difference in self-efficacy responses between the two groups. However, after the intervention, the mean self-efficacy response in the intervention group increased significantly, while the control group did not show significant changes. This study was conducted by Malmir *et al.*, aiming to investigate the effectiveness of an educational intervention based on protective motivation theory (PMT) in preventing cervical cancer among marginalized women in western Iran. The findings suggest that implementing such an intervention and increasing perceived self-efficacy can help prevent cervical cancer and promote regular Pap smear testing [31].

Chalermrueangrong & Preechawong have conducted a study that implemented an intervention based on the protective motivation theory. The intervention have successfully reduced smoking behavior and helped prevent NCDs in the intervention group. In addition, recent research has shown that educational interventions, along with improving self-efficacy and perceived self-efficacy, can lead to the adoption of healthier behaviors related to NCDs [32].

Regarding the aim of establishing "guidelines for action in the intervention and control groups before and after the intervention", the findings indicated that there was no significant difference in the mean guidelines for action between the control and intervention groups at the beginning of the study.

However, after the intervention, the guidelines for action in the intervention group increased significantly, while the change in the group was not significant. In addition, the study by Dashti *et al.* also showed a significant increase in the guidelines for action scores at the post-intervention stage [22]. A high score for action instructions suggests that the study subjects had effective external cues and stimuli that encouraged them to adopt disease-prevention behaviors [33]. This finding is consistent with the results of a recent study.

Educational interventions based on risk perception models and protective motivation theory can significantly influence health system decision-making.

These interventions enhance various factors, including awareness, behavioral intention, perceived susceptibility, perceived severity, perceived benefits and barriers, self-efficacy, and self-efficacy responses. Given that educational interventions are effective tools for preventing and managing noncommunicable diseases, and considering the increasing prevalence of these diseases, investing in such programs can lead to improved public health outcomes and reduced medical costs. Therefore, it is recommended that policymakers focus on promoting and implementing targeted educational programs within communities.

These initiatives can play a crucial role in encouraging healthy behaviors and facilitating access to noncommunicable disease prevention and care services.

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Study limitations:

1- Lack of follow-up after the intervention.

2- Requirement of literacy to participate in the study.

3- The study was conducted in different geographical areas with varying levels of access to resources.

Suggestions for future studies:

1- To effectively monitor and observe health behaviors, future studies should include multiple follow-ups over a longer duration.

2- Given the growing use of social networks, it is recommended to develop a system that curates scientific content, presenting it through various channels with proper scientific references.

3- Considering the success of the current study, it is advisable to utilize virtual networks to encourage or promote other behavioral changes.

4- As comprehensive access to services for the prevention and care of non-communicable diseases is essential, future research should encompass a broader range of services and focus on all aspects of care for non-communicable diseases.

Conclusion

Implementing an educational intervention based on the health belief model and protection motivation theory increases the perception of the risk of noncommunicable diseases. This approach leads individuals to adopt healthier behaviors. Given that educational interventions are known to be an effective tool for the prevention and management of noncommunicable diseases,

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