



## Effect of Educational Intervention Based on the Expanded Health Belief Model on Antiretroviral Therapy Adherence in the Patients with AIDS



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### ABSTRACT

**Background:** Antiretroviral treatment could reduce the mortality rate of HIV and prevent the disease progression and prolonging their life span. The present study aimed to assess the effects of education based on expanded health belief model on the treatment adherence of AIDS patients.

**Methods:** This study was conducted on 72 AIDS patients. The subjects were divided into two groups of intervention and control. Data were collected using a questionnaire and Morisky medication adherence scale. After the pre-test, training sessions were implemented for the intervention group. Post-test was completed after three months. Data analysis was performed in SPSS version 22 using independent t-test, Chi-square, and univariate analysis of covariance.

**Results:** No significant differences were observed in perceived susceptibility ( $P = 0.19$ ), perceived benefits ( $P = 0.31$ ), perceived barriers ( $P = 0.92$ ), perceived self-efficacy ( $P = 0.14$ ), and perceived social support ( $P = 0.15$ ). However, significant differences were denoted in perceived severity ( $P = 0.01$ ) and treatment adherence ( $P < 0.01$ ) between intervention and control group in the post-test phase.

**Conclusion:** According to the results, the expanded health belief model could be used in the training of AIDS patients to enhance their health beliefs, which in turn increases their adherence to antiretroviral treatment.

## 1. Introduction

Acquired immune deficiency syndrome (AIDS) is a new disease that is caused by the human immunodeficiency virus (HIV) and affects the immune system [1].

HIV increases the feeling of vulnerability, physical symptoms and disturbed thoughts in the affected person. In addition, frequent referral to physicians and high costs of treatment and drug complications reduce the quality of life

in patients [2].

According to the statistics of the World Health Organization (WHO), the number of HIV patients reached 36.7 million in 2016 across the world. In mid-2017, 20.9 million individuals with HIV received antiretroviral therapy (ART) globally. In Iran, the number of HIV patients was reported to be 66,000 (37,000-120,000) by 2016, 14% (9,300 cases) of whom received ART [3].

Highly active antiretroviral therapy (HAART) is defined as the use of three or more antiretroviral medications containing a minimum of one protease inhibitor or non-nucleoside reverse transcriptase [4]. According to the literature, 10% of the patients receiving HAART show resistance to the medications after two years. Within six years after the initiation of HAART, 30% of the patients may experience treatment failure and major resistant mutation. Adherence to ART is considered in the case of using 95% of the prescribed medications [5].

One of the consistent findings in the adherence literature denotes a direct association between poor adherence and the complexity of drug regimens, as well as the number of various medications in the regimen and the extent to which the regimen interferes with the daily life of the patients [6].

Many patients with chronic diseases may withdraw from or neglect adhering to the recommended treatment regimens due to exhaustion, treatment prolongation, and disappointment with the therapy [7]. Development of drug-resistant strains affects the patients and is considered to be a public health risk if the drug-resistant strain is transmitted to others [6]. Positive and negative perceptions of the medications and attitude of patients toward the benefits of medication play a pivotal role in the treatment adherence of patients [8].

The promising new combination therapies for HIV infections have profound implications for the patients with AIDS. While emphasis has mostly been placed on the beneficial effects of these therapies, there are concerns that the complexity of the regimens, which often involve using more than two dozens of pills, tablets or capsules daily, may require total adherence since the long-term nature of the treatment may lead to adherence issues. Successful combination therapies could result in undetectable levels of HIV viral load. On the other hand, lack of adherence lowers the success of the treatment and may lead to the development of resistant viral strains. The emergence of resistant strains is a risk to the affected patients and public health as these strains could be transmitted to others, thereby limiting treatment alternatives [9].

The value of health education programs depends on their efficacy measure, which in turn is correlated with the proper application of the related theories and models in health education [10]. The health belief model is an efficient approach in health education, which focuses on the wisdom and attitude of patients and their effects on adherence to treatment [11]. According to the health belief model, the motivation to adopt a health behavior consists of three categories, including personal perception, moderator behavior, and possibility of fulfilling the behavior. Personal perception is a factor that affects the perception of a disease, as well as the consequences of a health behavior. Personal perception discusses the possibility of acting on the factors that affect the likelihood of adopting appropriate behaviors. Moderating or facilitating factors include demographic

variables, perceived threat, and act guide, which are involved after the emergence of personal perception [12].

On the other hand, researchers have focused on the role of social support in various social behaviors associated with HIV infection [13]. According to Haus, social support is the functional content of relations that is classified into four categories of supportive behaviors, including emotional support (love, trust, and attention), material support (material and service support), information support (recommendations and information), and evaluation support (making advantageous information available for self-assessment) [14]. Comprehensive social support largely influences the treatment adherence in the patients with AIDS, as well as their survival and prevention of disease spread [15].

The present study aimed to evaluate the effects of an educational intervention based on the extended health belief model on the adherence of patients with AIDS with ART.

## 2. Materials and Methods

This interventional study was conducted on the patients diagnosed with AIDS referring to the Behavioral Diseases Counseling Center in Qom, Iran during 2015-2016.

There were 490 active cases of HIV-positive patients at the Behavioral Diseases Counseling Center, 198 of which received ART. Using census sampling and considering the inclusion criteria, 72 patients were enrolled in the study. The subjects were divided into two groups of intervention and control via simple random sampling (36 patients per each group).

The inclusion criteria of the study were as follows: 1) 95% antiretroviral medication adherence by the patients (receiving medications 23 times within the past two years); 2) willingness to participate in the educational intervention; 3) no imprisonment record within the past two years and 4) receiving ART for two years. The exclusion criteria were imprisonment during the research and absence for more than one session in the educational program.

Data were collected using a valid, reliable researcher-made questionnaire based on the expanded health belief model constructs and Morisky medication adherence scale [16]. The questionnaires, which consisted of three sections, were completed anonymously and coded in accordance with the names of the patients. The first section included data on the age, literacy, drug use, history of injection addiction, and disease transmission. The items in the second section were about the variables of the expanded health belief model (EHBM), including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy (six items each), and perceived social support (seven items). The third section of the questionnaire had eight items regarding ART adherence. The items in the questionnaire were scored based on a four-point Likert scale (Completely Agree, Agree, Disagree, and Completely Disagree) regarding the EHBM variables. The first five

variables were grade within the score range of 6-24, and the variable of perceived social support was scored within a range of 7-28.

With respect to the variable of treatment adherence, the first seven items were responded with "Yes" (score one) or "No" (score zero). Item eight had five options, including "Never" (score one), "Rarely", "Sometimes", "Unusually", and "Always" (score zero).

The reliability of the questionnaire was assessed using the Cronbach's alpha, which was estimated at 0.72 for perceived susceptibility, 0.85 for perceived severity, 0.89 for perceived benefits, 0.80 for perceived barriers, 0.82 for perceived self-efficacy, 0.77 for perceived social support, and 0.87 for therapy adherence behaviors. In order to determine the validity of the questionnaire, the EHBM scale was provided to seven health education experts, epidemiologists, and statistics and infection specialists, and their corrective comments were applied. The validity of Morisky medication adherence scale has been confirmed for the Iranian population by Negarandeh et al. (2013) [17].

Initially, a pretest was performed on the participants of the intervention and control groups under the supervision of the researcher at the Behavioral Diseases Counseling Center in Qom. Afterwards, the first session of the educational program was implemented for one hour, the subject of which was introducing the immune system and its function, types of immunity, procedure of viral entry to the immune system, and CD4 cells. The second session was held two days after the first session for one hour, focusing on the general definition of AIDS, routes of HIV transmission, and disease processes. The third session was about the conditions of treatment initiation, introducing medications and their side-effects, benefits of treatment adherence, and the required medical tests; this session was implemented two days after the second session.

The educational intervention was in the form of lectures, question-and-answer, and film and image display. At the end of the sessions, all the educational contents were delivered to the intervention group in the form of pamphlets and booklets. Posttest questionnaires were completed by the intervention and control groups three months after the educational intervention.

Prior to the study, research objectives were explained to the participants, and they were assured of confidentiality terms regarding their personal information. In addition, written informed consent was obtained from all the patients. After the intervention, the patients in the control group were also provided with all the educational contents of equal quality and quantity.

### 2.1. Statistical Analysis

Data analysis was performed in SPSS version 22 using independent t-test, paired t-test, Chi-square, and univariate analysis of covariance (ANCOVA).

### 2.2. Study Limitations

One of the limitations of the present study was the lack of similar research, and the findings could not be compared. Due to the confidentiality associated with AIDS, the invitation to the relatives of the patients and their families was accompanied by trials and difficulties to gain their support. Another limitation was methadone and drug abuse in some of the patients, which might have caused drug interference and affected the compliance of the patients with the treatment. Furthermore, we had limited access to AIDS records and cases due to the mentioned confidentiality.

## 3. Results and Discussion

As indicated in Table 1, independent t-test showed there were no statistically significant difference in age ( $P = 0.456$ ) and duration of treatment ( $P = 0.606$ ) between the intervention and control groups. Also, the result of the Chi square test in table 2 demonstrated no significant differences between the intervention and control groups in education level ( $P = 0.499$ ), drug use ( $P = 0.056$ ), injection addiction record ( $P = 0.155$ ) and duration of treatment ( $P = 0.833$ ).

**Table 1:** Demographic variables of the participants in both intervention (N = 36) and control groups (N = 36)

Variable	M ± SD		P value
	Intervention	Control	
Age	36.72 ± 7.62	38.17 ± 9.01	0.465
Duration of treatment (month)	57.31 ± 25.69	54.42 ± 21.48	0.606

\*Data are presented as Mean ± Standard Deviation

\*The age is based on the year

**Table 2:** Demographic variables of the participants in both intervention (N = 36) and control groups (N = 36)\*

Variables	Intervention N (%)	Control N (%)	P value
Education level			0.499
Illiterate	4 (11.1)	1 (2.8)	
Elementary	18 (50)	18 (50)	
Guidance	8 (22.2)	11 (30.6)	
High school	6 (16.7)	5 (13.9)	
College	0 (0)	1 (2.8)	
Drug use			0.056
Yes	16 (44.4)	25 (69.4)	
No	20 (55.6)	11 (30.6)	
Injection adiction			0.155
Yes	16 (44.4)	23 (63.9)	
No	20 (55.6)	13 (36.1)	
Transmission method			0.833
Injection	1 (2.8)	1 (2.8)	
Sex	16 (44.4)	12 (33.3)	
Mother to baby	1 (2.8)	1 (2.8)	
Other	2 (5.6)	1 (2.8)	
Injection / Sex	13 (36.1)	13 (36.1)	
Injection / Sex / Other	2 (5.6)	5 (13.9)	
Injection / Other	1 (2.8)	2 (5.6)	
Sex / Other	0	1 (2.8)	

\*Data are presented as Number (percent)

**Table 3:** Independed t- test for EHBM and treatment adherence variables before the intervention between both control and intervention group

Variable	Group	M ± SD*	P value	T
Perceived Susceptibility	Intervention	89.20 ± 10.86	0.195	1.309
	Control	85.56 ± 12.44		
Perceived Severity	Intervention	85.32 ± 10.76	0.894	0.134
	Control	84.97 ± 11.01		
Perceived Benefit	Intervention	88.73 ± 11.02	0.898	0.128
	Control	88.39 ± 10.71		
Perceived Barrier	Intervention	85.22 ± 12.23	0.806	0.246
	Control	84.37 ± 17.14		
Perceived Self_Efficacy	Intervention	86.55 ± 11.88	0.788	0.269
	Control	85.71 ± 14.31		
Perceived Social Supor	Intervention	82.14 ± 13.18	0.392	-0.861
	Control	84.82 ± 12.35		
Treatment Adherence	Intervention	34.09 ± 2 3.24	0.550	- 0.601
	Control	37.50 ± 23.81		

**Table 4:** ANCOVA for EHBM and treatment adherence variables after the intervention in both control and intervention group

Variable	F	P value
Perceived susceptibility	1.69	0.19
Perceived severity	4.53	0.01
Perceived benefits	1.16	0.31
Perceived barriers	0.07	0.92
Perceived self-efficacy	1.99	0.14
Perceived social support	1.92	0.15
Treatment adherence	7.81	0.001

Table 3 shows the comparison of EHBM variables. As can be seen, the results of independent t-test showed no significant differences in the perceived susceptibility ( $P = 0.195$ ), perceived severity ( $P = 0.894$ ), perceived benefits ( $P = 0.898$ ), perceived barriers ( $P = 0.806$ ), perceived self-efficacy ( $P = 0.787$ ), perceived social support ( $P = 0.392$ ), and treatment adherence ( $P = 0.550$ ) between the intervention and control groups before the educational program.

The results of ANCOVA demonstrated no significant differences in the variables of perceived susceptibility ( $P = 0.191$ ), perceived benefits ( $P = 0.318$ ), perceived barriers ( $P = 0.926$ ), perceived self-efficacy ( $P = 0.143$ ), and perceived social support ( $P = 0.154$ ) between the study groups after the intervention. On the other hand, significant differences were observed between the intervention and control groups in terms of perceived severity ( $P = 0.014$ ) and treatment adherence ( $P = 0.001$ ) (Table 4).

According to the results of the present study, patient education based on the EHBM significantly increased the variables of perceived severity and treatment adherence in the intervention group compared to the control group. However, no significant differences were denoted in the other EHBM between the intervention and control groups after the educational program.

Our findings suggested that perceived susceptibility increased significantly in the intervention group compared to the control group after the educational program. This is consistent with the results obtained by Pirzadeh et al. (2014) [18].

In another study, Karimi et al. (2014) investigated the influential factors in the treatment adherence of the patients with tuberculosis. According to the findings, perceived susceptibility was a significant predictor of adherence to tuberculosis treatment [19].

In another research, Kamran et al. (2014) evaluated treatment adherence in the patients with hypertension, claiming that the subjects with a higher perception of their disease had better compliance with the treatment process [20]. In the current research, it seems that implementing routine and repeated educational sessions in the form of positive thinking protocols and patient training, along with raising the awareness of patients toward the risks associated with lack of treatment adherence before educational interventions, could explain the lack of increase in perceived susceptibility after the intervention.

During the present study, a significant difference was observed in the score of perceived severity between the intervention and control groups after the educational program, which is in line with the study by Sadeghi et al. (2016) [21]. Furthermore, Shameena et al. (2017) investigated treatment adherence in the patients with hypertension at a medical center in south India, reporting a significant association in this regard [22]. One of the reasons for the effectiveness of the EHBM model in the management of AIDS is the unpleasant consequences of the disease, as well as the lack of treatment adherence, which encourages the patients to adopt preventive behaviors when they realize the outcomes and consequences of their disease. In the present study, emphasis on the tangible consequences of AIDS and lack of treatment adherence through film and image display based on the EHBM model could increase perceived severity in the patients.

Findings of the current research indicated no significant difference in the perceived benefits between the intervention and control groups after the educational program. Similarly, Sadeqhi et al. (2016) reported no significant difference in the mean perceived benefits between the study groups after the intervention [21]. However, the results obtained by Kamran

et al. confirmed increased perceived benefits between the study groups after the educational intervention [20].

In the research by Barclay et al. (2007) one of the reasons for the failure in treatment adherence among young AIDS patients rather than the elderly patients was reported to be the lack of the proper understanding of the benefits of ART [23].

According to the EHBM, individuals do not accept health recommendations unless they perceive the potential benefits of health behaviors. Some of the most important benefits of treatment adherence are the prevention of family infections, rapid return to the workplace, eliminating infections, and increasing CD<sub>4</sub> in the patients. Ambiguity regarding the benefits of treatment for patients with HIV infection may be due several factors, such as living far from the family, rejection by family and friends, delayed increase of CD<sub>4</sub>, and lack of substantial recovery following ART.

In the current research, no significant differences were observed in the variables associated with perceived barriers between the intervention and control groups after the educational program. The findings of Shameena et al. (2017) and Rosenstock regarding the EHBM and preventive health behaviors revealed significant, predictive perceived barriers as a result of non-adherence to treatment in the patients with hypertension [22, 24]. Some of the significant barriers for AIDS patients in treatment adherence include discrimination and prejudice, travel costs, side-effects of antiretroviral medications, using traditional therapies, addiction, and alcoholism. Unfortunately, most of these limitations cannot be solved through educational interventions. It is possible to decrease the considered perceived barriers through community education by the mass media, consultation about preparation for starting ART, increasing access to behavioral disease counseling centers, and expanding addiction and alcoholism rehabilitation centers and encouraging patients to refer to these patients. Therefore, most of the barriers in this respect cannot be solved by researchers and implementing educational programs only.

In the present study, the mean scores of the variables of self-efficacy had no significant differences between the intervention and control groups after the educational program. Similarly, Knob et al. reported no significant correlation between self-efficacy and treatment regimen admission [25]. On the other hand, the findings of Karimi et al. (2014) indicated the significant, predictive value of self-efficacy for the adherence of tuberculosis patients to the treatment [19]. In addition, the findings of Luszczynska et al. (2007) demonstrated a direct association between self-efficacy, treatment adherence, and physical function of patients [26].

Based on the aforementioned studied, it seems that individual education, especially before the beginning of the treatment along with mental health consultation in behavioral disease counseling centers, could contribute to improving self-efficacy. Self-efficacy is directly correlated with the quality of life of patients with AIDS through

improving their material and mental state, controlling medication side-effects, and reducing the number of medications through using combined medication. These factors have been shown to increase the self-efficacy and adherence of patients to ART.

In the current research, no significant difference was observed in the mean perceived social support between the intervention and control groups. Consistently, Luszczynska et al. (2007) claimed that perceived support had no direct association with adherence to ART, while it has a modifying role in the self-efficacy of patients in adherence to ART [26]. In this regard, Pang et al. investigated the effects of social support on the treatment adherence of hemodialysis patients, and the results indicated that the support of family members and other important individuals was the most significant influential factor in the medication adherence of the patients [27].

Support may consist of financial support, information support (e.g., education), and emotional support (e.g., support by the family, spouse, sexual partner, and friends). It seems that the support of relatives through face-to-face education and presence of one close family member during medication counseling sessions before treatment (as in the AIDS treatment protocol) could be helpful in increasing family support. Social support could be influenced by several factors, such as not disclosing the disease by the patients with AIDS due to the fear of discrimination, prejudice and stigma, and rejection by the family, friends, and relatives, limited participation of families in educational sessions due to the ignorance of the disease or lack of attention to the patients and their disease.

In the current research, a significant difference was observed in the treatment adherence of the patients in the intervention and control groups after the educational program. In the study by Reisner et al. (2009) two factors were reported to be effective in the treatment adherence of AIDS patients. The first factor was the treatment regimen, in which the increasing number of the medications and treatment duration had a strong correlation with the reduction of treatment adherence. The other factor was the follow-up of the patients and attention to the treatment by physicians, which remarkably enhanced treatment adherence [28].

In the study by Daryazade, 82.6% of the patients continued ART, and lack of adherence to ART was reported in 10.8% of the patients [29]. In the research by Paterson et al. (2000) the patients who adhered to 95% of the treatment had only 22% virologic failure, which equaled 2.6 days of hospitalization per 1,000 days of treatment adherence. Moreover, the patients with 80-95% adherence had 61% virologic failure, which equaled 12.6 days of hospitalization per 1,000 days of treatment adherence [30].

There are significant barriers against adherence to ART, some of which include amnesia, lack of proper understanding regarding the health benefits of the

medications, intensity of the side-effects, and the complications of the medicinal regimens. Evidently, treatment adherence could affect physical health, as well as the physical function of the patients, through influencing the virus frequency.

In the present study, the educational program improved the perception of the patients in the intervention group regarding the issues and consequences associated with non-adherence to treatment, thereby enhancing adherence to ART with regular medication use. This will increase the life expectancy and quality of life of the patients, while decreasing the disease burden and its transfer to the community and reducing the healthcare costs, thereby promoting community health.

#### 4. Conclusion

Considering that the proper and timely treatment of patients with AIDS could prevent the disease progress and deterioration, selecting a proper educational method could largely contribute to the quality of life of the patients. According to the results, the training of AIDS patients based on the EHBM regarding the importance of treatment, reducing the drug side-effects, and increasing the willingness of the patients to medication use could enhance their perception of the severity of the disease, which in turn increased their adherence to ART. Increased treatment adherence could significantly decrease the disease severity, transmission, and costs in AIDS patients.

#### Authors' Contributions

Gh.Z., and Y.J. designed and directed the project; Y.J., wrote the manuscript; Gh.Z., Sh.Gh. and M.S. performed the experiments; Gh.Z., and Y.J., analysed data; Gh.Z., and Y.J., made the simulations; Gh.Z., Sh.Gh. and M.S. developed the theoretical framework.

#### Conflict of Interest

The authors report no conflict of interest.

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