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Information Technology-Driven Education: Virtual Social Networks vs. Traditional Face-to-Face Approaches in Medication Adherence in Patients with Hypertension

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Abstract

Background: Ensuring that patients adhere to their medication is vital for effectively managing hypertension. Implementing educational interventions using social networks can be a practical approach to promote patient adherence.

Aim: The present study was conducted with aim to compare the impact of virtual social network-based education against traditional face-to-face education on medication adherence in individuals with hypertension.

Method: This randomized clinical trial was conducted on 210 patients with hypertension referred to the heart clinics affiliated to Zanjan University of Medical Sciences. The participants were allocated to three groups. Educational intervention was conducted in 4 sessions and during 4 weeks for virtual and face-to-face training groups. The data were collected using the demographic form and Morisky medication adherence scale (MMAS-8) before, one and three months after the intervention. Data were analyzed using SPSS software (version 16) and Chi-square, ANOVA and Repeated Measures tests.

Results: There was a statistically significant difference in the mean medication adherence score among the three study groups before the intervention (F=4.18; p=0.017), one month (F=68.85; p=0.0001), and three months (F=64.78; p=0.0001) after the intervention. The mean medication adherence score in the virtual and face-to-face education groups was significantly higher than the control group at one and three months after the intervention (p=0.0001); however, no statistically significant difference was observed between the two intervention groups (p=0.999).

Implications for Practice: Educational strategies that social networks and face-to-face training can help individuals manage hypertension. Virtual education can be a cost-effective alternative to traditional approaches, but face-to-face education is also practical.

Keywords: Face-to-Face Education, High Blood Pressure, Medication Adherence, Online Education, Patient Education

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Introduction

Hypertension (HTN) is a common chronic condition among adults worldwide and is currently defined as a systolic blood pressure (SBP) of ≥130 mmHg or a diastolic blood pressure (DBP) of ≥80 mmHg (1, 2). HTN is considered a significant public health issue and a risk factor for diseases such as stroke, heart disease, and kidney failure (2, 3). This chronic disease accounts for approximately 13% of global mortality (4). In 2019, the standardized prevalence of HTN in individuals aged 30 to 79 years was 32% in women and 34% in men (5). Similarly, in Iran, the prevalence of HTN is estimated to be 23% (6). Research has revealed that uncontrolled HTN might increase the risk of ischemic heart disorders by 3–4 times (7). In addition, the incidence of cardiovascular complications linked to HTN in Asian patients is increasing, which poses a considerable social and economic burden on this region (4). The yearly costs of HTN worldwide are estimated to be more than 370 billion dollars. However, by adequate management of HTN, the costs associated with this illness can be lowered to 100 billion dollars per year (8).

Like other chronic illnesses, HTN is impacted by a combination of psychological, behavioral, and physical factors (9). Although there are several proven techniques available for lowering blood pressure, such as lifestyle changes and pharmacological therapy, many patients need help adhering to blood pressure control guidelines (10). Medication adherence in patients with HTN was defined as "the extent to which the medication-taking behavior of a patient is consistent with the recommendations provided by health care providers" (11). According to the evidence, 50-80% of people with HTN have poor medication adherence. Approximately 10% of patients remove a part of their medical plan on their own, and nearly half of them quit following the prescribed drug regimen in the first year after being diagnosed with this disease (12,13). Various reasons, such as a lack of understanding of the disease, the necessity for long-term treatment, unpleasant drug reactions, and lack of access to healthcare, medical facilities, and drugs, contribute to poor medication adherence in patients with HTN (7).

Awareness of the essential and most effective techniques for regulating blood pressure is critical for starting and following treatment in people with HTN. A lack of understanding the harmful implications of HTN can hinder people from creating or adhering to treatment. Similarly, patients may comprehend the necessity of controlling blood pressure but may need to be made aware that daily medication is the most effective strategy for treating HTN (13). Since poor medication adherence is known to be associated with insufficient blood pressure control, more than 75% of patients who have poor adherence to treatment do not reach ideal blood pressure (11). Therefore, knowledge of this subject is needed to improve health outcomes. Education can be offered in numerous ways, including face-to-face and virtual education (14,15).

The rapid development of smart devices in recent decades has led to their widespread application in all facets of human existence. Since 2022, there are approximately 6.8 billion smartphone users globally (16). Smartphones are favored tools for communicating and accessing information. The use of smartphones is one of the techniques that can enhance medication adherence in patients with HTN and can be utilized to offer healthcare to these patients (12). Smartphones provide different services, such as text messages, emails, phone calls, and mobile apps, which can be utilized for patient education. This strategy can help attain universal health coverage by eliminating geographic barriers, expanding access, and providing healthcare to isolated and disadvantaged communities. Furthermore, monitoring clinical data, offering educational information, and facilitating contact between doctors and patients through smartphones are more cost-effective than face-to-face training (8).

The studies regarding the influence of face-to-face (14,17) and virtual (15,18) training methods shows that using both methods affects HTN control. However, different outcomes have been found in research comparing the effect of education through virtual social networks with that through face-to-face teaching for various disorders (19,20). To our knowledge, the current study is the first that directly compared the effects of two methods of social media-based education and face-to-face education on medication adherence in patients with HTN in the cultural and social context of Iran. Therefore, the present study was conducted with aim to compare the impact of educational interventions based on virtual social networks with face-to-face education on the medication adherence of patients with HTN.

Methods

This randomized controlled trial with parallel groups was performed on 210 patients diagnosed with HTN referred to the heart clinics of Ayatollah Mousavi Hospital and Valiasr Hospital, affiliated with Zanjan University of Medical Sciences, Zanjan, Iran. The study was conducted between November 15, 2022, and October 23, 2023. The inclusion criteria were patients older than 18 years of age with at least a 6-month history of HTN confirmed by a cardiologist who were literate and had access to a smartphone and internet. Patients with HTN were not included in the study if they were resistant to treatment, developed secondary hypertension, or had severe mental disorders. Participation in similar research at the same time and benefiting from different educational modalities (virtual and face-to-face) were considered as exclusion criteria.

The sample size was determined using the G*Power software (version 3.1.9.4) and based on the one-way analysis of variance (one-way ANOVA) test. Considering a significance level of 0.05, a power of 80% in three groups and a medium effect size (Cohen's f) of 0.233 (21), 61 people were calculated in each group. Considering a 15% probability of sample attrition, 70 people were estimated in each group. Participants were included in the study by a convenience sampling method and were allocated to three groups: virtual training, face-to-face training, and control. To ensure equal and homogeneous group sizes, eligible patients were assigned to three groups using a block randomization method with a block size of 6. Code A was assigned to the virtual training group, code B to the face-to-face training group, and code C to the control group. All possible block shapes were placed in sealed envelopes, numbered, and randomly selected for allocation. The allocation of patients to groups was done independently by the researcher. In this trial, blinding was not performed (open-label), and the patient and the researcher were aware of the type of intervention.

The educational intervention was implemented in both face-to-face and virtual education groups in 4 consecutive weekly sessions for 4 weeks. In the face-to-face training group, the educational intervention was conducted individually in the heart clinic for 45 minutes. The educational content included theoretical material, questions and answers, and practical training. In the social networks - based virtual education group, the same educational content was sent in the form of text, voice messages, images, and educational videos in a WhatsApp group in four sessions (weekly). The time required to view and study the educational package was estimated to be approximately 45 minutes. Participants were asked to study each week's content within a designated time frame. Interaction with participants was two-way and continuous through the WhatsApp group. Individuals could ask their questions in the group and they were answered on the same day (Table 1).

Table 1. Summary of educational sessions for face-to-face, virtual, and control groups

Group	Session	Content	Method
Face-face (Individually)	1	Nature of HTN; factors influencing HTN	lectures and interactive question-and-answer
	2	Review of previous session; control of HTN; importance of control	PowerPoint and instructional software
	3	Review of previous content; importance of medication and behavioral regimens adherence and their impact on HTN	lectures and interactive question-and-answer
	4	Summary of previous session; practical BP measurement by participants; teaching family members	Demonstration & hands-on practice
Virtual (WhatsApp)	1	Nature of HTN; factors influencing HTN	Text & voice message; group discussion
	2	Review of previous session; control of HTN; importance of control	PowerPoint slides with pictures; text & voice
	3	Review of previous content; importance of medication and behavioral regimens adherence and their impact on HTN	Text & voice message
	4	Summary of previous session; practical BP measurement by participants; teaching family members	Video tutorial; Text & voice
Control	-	Routine care from health providers	Standard care (no structured intervention)

The data-gathering tools were the Demographic Information Questionnaire and the Morisky Medication Adherence Scale (MMAS-8). The Demographic Information Questionnaire encompasses the following factors: age, gender, marital status, education level, place of residence, occupation, duration of HTN, family history of HTN, living with family, history of heart diseases and smoking. This questionnaire was administered to all participants before the intervention.

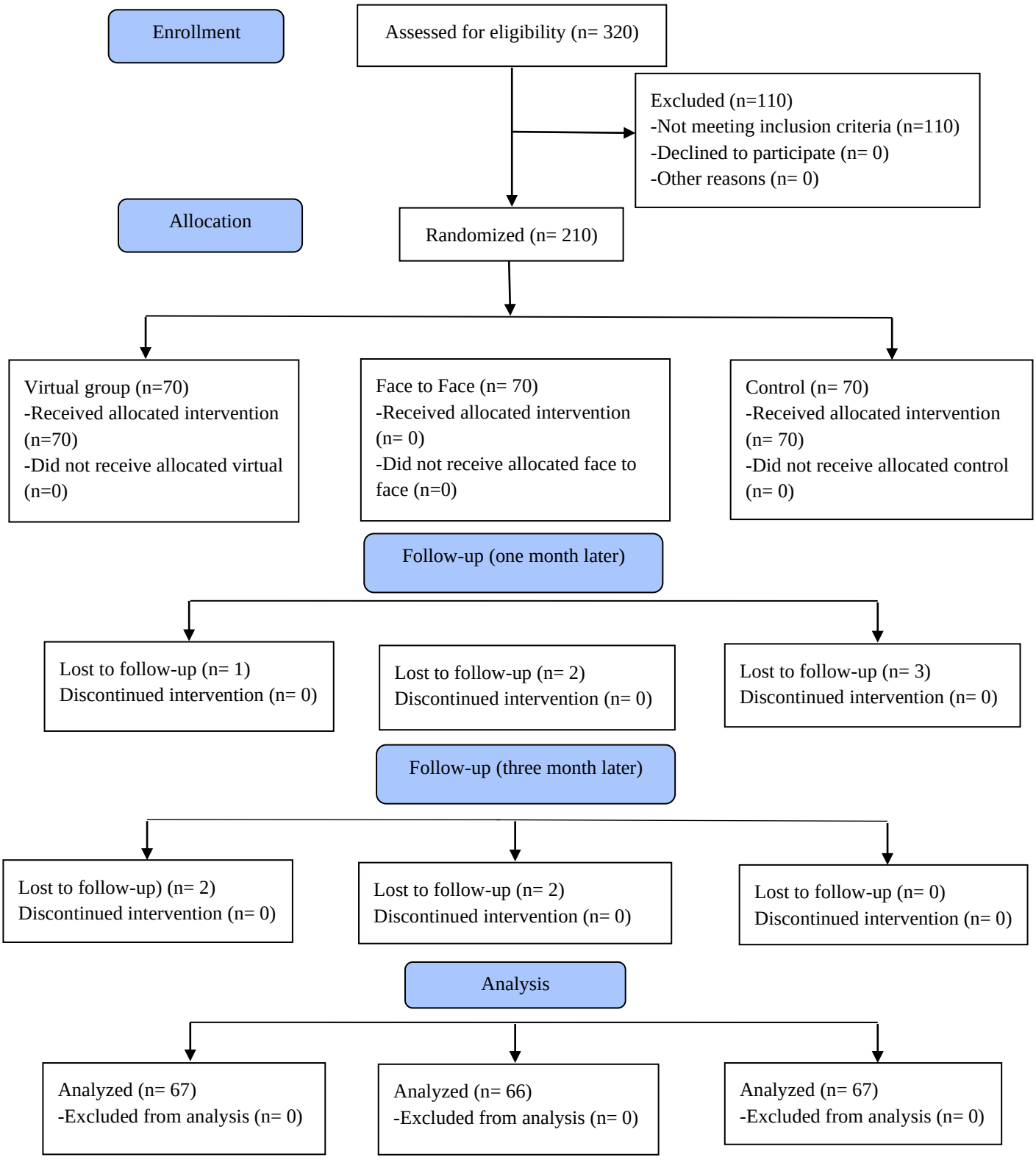

Figure 1. Flow diagram of the study process

Morisky Medication Adherence Scale (MMAS-8) was used to assess the degree to which patients adhered to drug treatment (22). Before the Morisky scale was used, approval from the instrument's manufacturer was sought. The medication adherence questionnaire has 8 questions. Questions 1 to 7 are scored as yes/no responses. "Yes" responses are scored as 1 and "no" responses are scored as 0. Question 5 is scored in reverse. Question 8 is scored on a 5-options Likert scale with responses of never (1), rarely (0.75), sometimes (0.5), usually (0.25), and always (0). The scores on the questionnaire ranged from 0 to 8. Scores less than 6 indicated weak adherence, scores between 6 and 8 represented moderate adherences, and a score of 8 indicated good adherence. Previous research has examined and confirmed the validity and reliability of the Morisky scale for Iranian society (23). Cronbach's alpha coefficient was reported between 0.69 and 0.83 (23, 24). Participants in the study groups answered this questionnaire before, one, and three months after the intervention. Calibrated blood pressure equipment was also utilized to measure systolic and diastolic blood pressure.

A total of ten participants withdrew from the study due to failure to complete the questionnaire, four of whom were in the face-to-face training group, three of whom were in the virtual training group, and three of whom were in the control group (Figure 1).

The data analysis was conducted using SPSS software (version 16). The Shapiro–Wilk test was used to analyze the distribution of the quantitative data, and the normality of the distribution was confirmed. In descriptive statistics, mean, standard deviation, frequency and percentage (%) were presented. In inferential statistics, chi-square, ANOVA, repeated measures ANOVA, and Bonferroni post hoc tests were used. $P<0.05$ was considered statistically significant.

Ethical Consideration

The study was approved by the Ethics Committee of Zanjan University of Medical Sciences (ethical code: IR.ZUMS.REC.1401.196). The study plan was registered on the Iran Registry Clinical Trial site (IRCT20140427017454N6). Informed consent was obtained from all study participants before participation, ensuring transparency and ethical conduct throughout the study.

Results

The mean age of the participants was 59.93±15.38 years and the duration of HTN was 7.95±6.61 years. The majority of study participants were female (55.50%), married (92.50%), had a diploma education (28%), and lived in the city (58%). Participants were similar and homogeneous in terms of demographic characteristics except for education level (p=0.043) (Table 2).

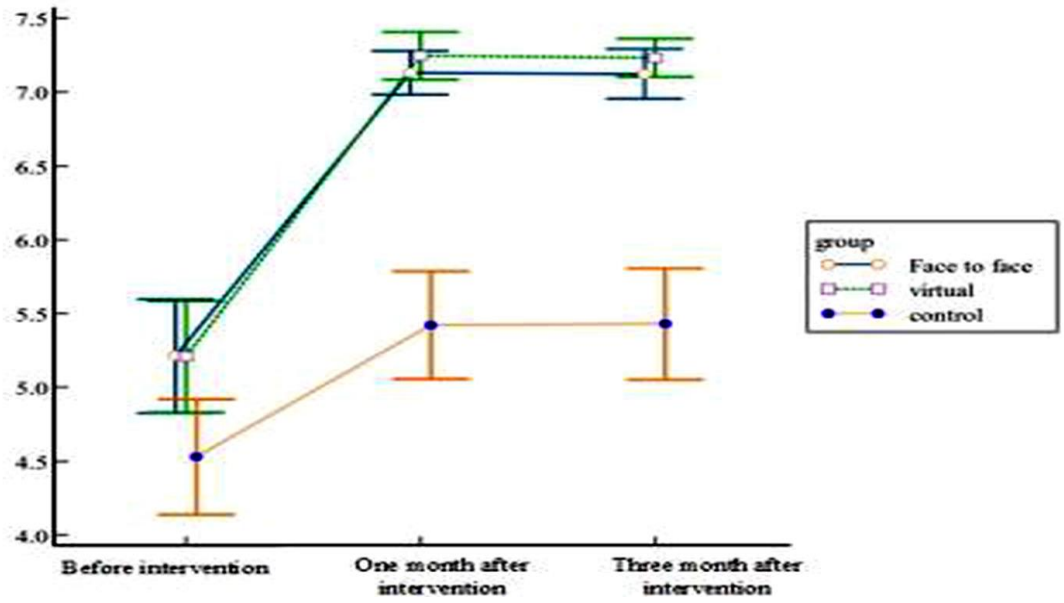

Figure 2. Comparison of the means medication adherence scores among the three groups

The results of the ANOVA test showed a statistically significant difference in the mean medication adherence score between the three study groups before (p=0.017), one (p<0.0001) and three months after the intervention (p<0.0001). Pairwise comparison results showed that at all times, medication adherence scores in the face-to-face and virtual education groups were significantly higher than the control group (p<0.05).; however, there was no significant difference between the two education groups (p=0.999). Within-group comparison showed that medication adherence scores increased significantly over time in each group (p<0.0001) (Table 3) (Figure 2).

Table 2. Demographic and clinical characteristics of participants in the three groups

Variables	Face-to-Face N (%)	Virtual N (%)	Control group N (%)	P-value
Gender				
Male	32 (47.80)	25 (37.90)	32 (47.80)	X^2 = 1.74, p= 0.417
Female	35 (52.20)	41(62.10)	35 (52.20)	
Marital status				
Married	62 (92.50)	61(92.40)	62 (92.50)	X^2 = 0.001, p= 0.999
Single	5 (7.50)	5 (7.60)	5 (7.50)	
Education				
Basic literacy	19 (28.40)	22 (33.30)	10 (14.90)	X^2 = 15.96, p= 0.043
Secondary school	10 (14.90)	6 (9.10)	16 (23.90)	
High school and Diploma	15 (22.40)	15 (22.70)	26 (38.80)	
Bachelor's degree	18 (26.90)	17 (25.80)	12 (17.90)	
Master's degree	5 (7.50)	6 (9.10)	3 (4.50)	
Place of residence				
City	31 (46.30)	42 (63.60)	43 (64.20)	X^2 = 5.69, p= 0.058
Village	36 (53.70)	24 (36.40)	24 (35.80)	
Occupation				
Government employee	16 (23.90)	18 (27.30)	8 (11.90)	X^2 = 12.36, p= 0.235
Worker	12 (17.90)	5 (7.60)	10 (14.90)	
Retiree	7 (10.40)	9 (13.60)	10 (14.90)	
Homemaker	26 (38.80)	30 (45.50)	30 (44.80)	
Unemployed	1 (1.50)	2 (3)	1 (1.50)	
Other	5 (7.50)	2 (3)	8 (11.90)	
Smoking				
Yes	13 (19.40)	11 (16.70)	21 (31.30)	X^2 = 4.66, p= 0.097
No	54 (80.60)	55 (83.30)	46 (68.70)	
History of heart disease				
Yes	32 (47.80)	30 (45.50)	18 (26.90)	X^2 = 0.07, p= 0.966
No	35 (52.20)	36 (54.50)	49 (73.10)	
Family History of HTN				
Yes	51 (76.10)	53 (80.30)	49 (73.10)	X^2 = 0.95, p= 0.619
No	16 (23.90)	13 (19.70)	18 (26.90)	
Living with family				
Yes	63 (94)	57 (86.40)	63 (94)	X^2 = 3.34, p= 0.188
No	4 (6)	9 (13.60)	4 (6)	
Age (years) Mean ± SD	58.01±12.39	59.16 ±15.92	62.61±17.28	F = 1.62, p= 0.199
Duration of HTN (years) Mean ± SD	7.95±7.77	8.31±6.37	7.58±5.57	F = 0.20, p= 0.815

Note: The chi-square test and ANOVA were used to compare participants based on qualitative and quantitative demographic variables, respectively.

Table 3. Mean of medication adherence scores among the three groups

Medication Adherence Scores	Virtual	Face-to-Face	Control Mean± SD	Comparison Between Group* F, p-value	Bonferroni Pairwise Comparison (p-value)	Repeated Measures ANOVA (Within-Group) F, p-value
Before intervention	5.20±1.52	5.21±1.57	4.52±1.60	F = 4.18, p = 0/017	Virtual-Control: p=0.041 Face-to-Face-Control: p=0.038 Virtual-Face-to-Face: p=0.999	F =113.01, $p < 0.0001$
One month after intervention	7.24± 0.66	7.13±0.60	5.42±1.48	F = 68.85, p < 0.001	Virtual-Control: p< 0.001 Face-to-Face-Control: p< 0.001 Virtual-Face-to-Face: p=0.999	F = 26.21, $p < 0.0001$
Three months after intervention	7.23±0.52	7.12±0.68	5.42±1.54	F = 64.78, p < 0.001	Virtual-Control: p< 0.001 Face-to-Face-Control: p< 0.001 Virtual-Face-to-Face: p=0.999	F = 23.95, $p < 0.0001$

*ANOVA

Repeated measures ANOVA showed that changes in medication adherence scores over time were significantly different among the three groups (p=0.006) and between-group changes were also significant in each group (p<0.001). However, the adjusted mean scores between the groups did not show a statistically significant difference (p=0872). The highest adjusted mean was observed in the virtual group and the lowest in the control group (Table 4). Bonferroni post hoc test showed that medication adherence scores in the virtual and face-to-face education groups were significantly higher than in the control group (p<0.001); however, no significant difference was observed between the education groups (p=0.999) (Table 5).

Table 4. Means changes of medication adherence scores among the three groups

Time * group	Repeated measure test (Between group)	Repeated measure test (Within Subjects)	Adjusted Mean ± SD	Groups
F = 0.13	F = 64.84	F = 7.69	7.06 ± 0.10	Face-to-Face
p = 0.872	p < 0.001	p = 0.006	7.16 ± 0.10	Virtual
			5.55 ± 0.11	Control

Note: Repeated measures tests were conducted both between groups and within subjects to compare changes in the mean and standard deviation of medication adherence scores over time.

Table 5. Bonferroni pairwise comparison of adjusted means of medication adherence scores

Groups		Mean ± SD	P-value
Face-to-Face	Virtual	-0.10 ± 0.14	0.999
	Control	1.50 ± 0.15	< 0.001
Virtual	Control	1.61 ± 0.15	< 0.001

Note: Bonferroni pairwise comparisons were also conducted to assess the differences in the adjusted means and standard deviations of the medication compliance scores between the groups.

Discussion

The purpose of the present study was to compare the impact of education provided through virtual social networks with traditional face-to-face approach on medication adherence in patients with HTN. The results showed that both face-to-face and virtual training approaches increased medication adherence in patients with HTN compared to the control group. However, there was no statistically

significant difference between the two educational strategies. This finding suggests that patients with HTN can benefit from both educational strategies to improve their medication adherence. The educational approach can be chosen based on patients' circumstances, preferences, and accessibility, without affecting treatment outcome. Further research and exploration could examine particular aspects impacting patient preference and involvement in these instructional modes.

According to the evidence, the similarity of educational content, session structure, and training duration in the two educational approaches in the present study can be mentioned as possible reasons for the lack of significance of the results between both strategies. Also, social network-based virtual education can be as effective as face-to-face education if it is interactive (25). Therefore, equality of the results can be expected.

Numerous studies have evaluated training methods for patients with HTN that involve both face-to-face and virtual approaches, all of which positively influence medication adherence in this patient population. Meredith et al.'s study in the U.S. revealed the results suggesting the usefulness of a face-to-face group education program. This 6-hour program, focused on nutrition, lifestyle, and medication adherence strategies for treating HTN, has proven to be a successful approach to caring for patients with HTN and improving their adherence to the treatment plan (17). The similarity of these results with the present study highlights the effective role of face-to-face training in improving medication adherence. Volpi et al.'s study emphasized the potential of mobile phone education for empowering hypertensive patients to manage their health and enhance medication adherence (26). Their results are consistent with our findings, further supporting the notion that alternative approaches, such as virtual instruction through mobile phones, can positively influence medication adherence among patients with HTN. Hosseinzadeh et al.'s study emphasized the usefulness of both face-to-face and social media-based training for improving self-care among pregnant women with gestational diabetes. Notably, no significant difference was detected when comparing the efficiency of the two training strategies (19), which was consistent with the present study (19). This finding aligns with the belief that varied educational techniques can provide equivalent outcomes.

Bijani et al. in their study aimed to compare multimedia education with traditional methods for promoting adherence to drug regimens in patients with high blood pressure, and demonstrated that the use of multimedia techniques, including text, voice, and video through mobile phones, was more effective than traditional face-to-face training conducted by nurses (27). These findings are consistent with our study, which demonstrated the positive benefit of using social networks to promote medication adherence in patients with high blood pressure. The variance in the efficiency of face-to-face training between the two studies could be related to the changes in teaching approaches, as our research involved interactive and two-way communication. Contrasting results were discovered in Robert et al.'s study, which examined online and face-to-face training for parents of children with autism. Virtual training was found to have a better effect on reducing children's night awakenings than face-to-face training (20). These differences may be due to the different nature of the diseases, the characteristics of the target population, and the socio-cultural context of the studies.

The evidence suggests that virtual education can reduce geographical barriers, improve access to health services in underserved areas, and reduce costs. However, face-to-face education still has great value in providing direct contact and human interaction. The choice of teaching method should be based on available resources and educational objectives.

This research had some limitations that should be addressed when interpreting the findings. The participants were literate and familiar with social networks; therefore, generalization of the results to all patients should be done with caution. The participants were confined to those at Ayatollah Mousavi Hospital and Valiasr in Zanjan, Iran. This restricts the external validity of the research results, and caution should be taken when attempting to generalize the findings to a broader population of patients with HTN. Another limitation was the three-month follow-up period. The outcomes may change with time, and longer-term follow-ups could provide a more nuanced picture of the persistent influence of the interventions. Differences in age, education level, and medication adherence scores before the intervention could have affected the results. Finally, the data collection technique relied on self-reports. Self-reports are vulnerable to bias, and individuals may provide responses affected by social desirability or other variables. While self-reporting is a typical strategy, future research should consider including additional objective measures or triangulating data from several sources to strengthen the robustness of the findings. These limitations reinforce the need for

cautious interpretation of the results and stress opportunities for development and refinement in future studies, including broader participant representation, extended follow-up periods, and diversified data-gathering methods.

Implications for practice

The results of this study revealed that face-to-face and virtual training approaches improved the medication adherence of patients with HTN during one-month and three-month after the intervention. Although, no statistically significant difference was observed between the effectiveness of these two methods. However, both methods can be used as effective strategies in improving the management of HTN. Virtual social network-based education, in addition to its easy access and ability to deliver content repeatedly, is cost-effective in terms of human resources and time, and can sometimes be a suitable alternative to face-to-face education in certain circumstances. However, quantitative cost-benefit analyses can be conducted in future studies to confirm the economic value of this educational method. It is suggested that future studies, in addition to comparing face-to-face and virtual methods, also examine the effectiveness of combining these two educational approaches. By increasing the follow-up period and expanding the scope of the study to other chronic diseases, they should provide more comprehensive evidence for designing effective educational interventions in the health system.

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Conflicts of interest

The authors declared no conflict of interests.

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Authors' Contributions

M.S. conducted the research and wrote the initial manuscript. K.A. supervised the study. F.GH. participated in the statistical analysis. F.GH., K.A., and F.R. revised the manuscript. The final version of the manuscript was approved by all the authors.

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