Comparing the effects of two methods of self-monitoring and telenursing on the blood pressure of patients with hypertension

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ABSTRACT

Hypertension is one of the most important and common cardiovascular diseases. Considering the long history of using different methods to cope with this disease, the success in controlling it has not been desirable. The aim of this study was to compare the effect of two methods of self-monitoring and telenursing on the blood pressure of patients with hypertension. This 3-group 4-stage clinical trial was conducted on 84 patients with hypertension who referred to Hypertension Research Center of Isfahan in 2015-16. Samples were first selected through simple sampling and then divided into three groups of self-monitoring, telenursing and control, each containing 28 patients, through continuous random allocation. Samples of the two intervention groups (self-monitoring and telenursing) participated in two educational sessions about high blood pressure. Samples of the telenursing group received messages about high blood pressure. Samples of the self-monitoring group measured and recorded their own blood pressure under supervision of one family member. Samples of the control group also participated in two educational sessions related to high blood pressure. Questionnaires were completed before the intervention and one, two and three months afterward and data were analyzed using SPSS 18 and Chi square test, one-way variance analysis, covariance analysis, variance analysis with repeated measures and kruskal-Wallis test. The mean of systolic and diastolic blood pressure of participants had no significant difference between three groups before the intervention. The mean of systolic blood pressure at the first month after the intervention was (p = 0.22), the second month was (p = 0.001) and the third month was (p = 0.001) which shows a significant difference between three groups at the second and third months after the intervention. The mean of diastolic blood pressure of the participants at the first month after the intervention was (p = 0.001), at the second moth was (p = 0.001) and at the third moth was (p < 0.001) which shows a significant difference between three groups. Self-monitoring and telenursing interventions could be effective on management of hypertension. In this study, telenusring was more effective in decreasing systolic and diastolic blood pressure compared to self-monitoring method. Considering the high prevalence of hypertension which has turned it into a main health problem, paying attention to its appropriate prevention, control and treatment should become a health priority and using simple and low cost methods would have a more effective role in controlling this disease.

Keywords: Self-monitoring, Telenursing, Hypertension, Nursing

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INTRODUCTION

Cardiovascular diseases are the most common causes of mortality in the world[1]. About 17.3 million deaths would occur by cardiovascular diseases in the world annually and its prevalence is increasing in a way that this number is predicted to raise to 23.6 million deaths in 2030[2]. Hypertension is one of the most important and common cardiovascular diseases. This disease is the main cause of disability and is considered the most important risk factor for mortality in the world. More than half of the people who are older than 55 years old have hypertension. Regarding the census of patients with high blood pressure, Iran is in the fifth global rank[3] . Different studies have mentioned a varied prevalence from 25 to 35% for hypertension among Iranian adults[4]. A study that was conducted in the health care system of Iran in 2011 revealed that at least 17.5% of 15-64 year old Iranians have high blood pressure. The increase in prevalence of hypertension in Iranian and global population is accompanied with occurrence of serious complications and has turned this disease into an important health problem[5].So that, according to the report by National Association of Blood Pressure, 54% of strokes, 47% of ischemic heart diseases and 25% of other cardiovascular disease are caused by hypertension[6]. Myocardial infarction, brain traumas, heart failure, visual disturbances, renal failure and early death are some of its other consequences[6]. Despite prominent and important advances in finding diseases' risk factors and complications, controlling and managing high blood pressure still are important matters in the field of health[7]. Controlling hypertension is of great importance in decreasing the rate of deadly non-communicable diseases and their rate of mortality. This would emphasis the necessity of in time diagnosis, prevention, control and treatment of hypertension. Reducing blood pressure could decrease the costs of advanced medical cares[8],decrease the rate of death by cardiovascular diseases and risk of strokes and renal failure. Despite many accessible medicinal treatments, various disappointing evidences are observed about the ineffective control of the disease[9]. International Society of Hypertension and National Blood Pressure Association have declared that more than 50% of people with high blood pressure are not aware of their condition[10].Also the success rate for controlling high blood pressure in the USA in just 27% and this rate in England, France and Germany is even lower [11].In Iran only 16.6% of patients with high blood pressure have controlled blood pressure (Cardiovascular Research Center, 2011). In the USA 80% of patients with high blood pressure are aware of their condition and 71% of them consume a type of antihypertensive. However, only 48% who are aware of their blood pressure condition have been able to control their disease properly[12].

Continuous monitoring and evaluation of blood pressure could be an important step in successful control of hypertension(Richard & el al 2010). Controlling and monitoring high blood pressure is one of the common goals of national and international associations of high blood pressure and also the World Health Organization. Regular measurement of blood pressure at home is necessary for improving the management and diagnosis of high blood pressure[14],[15]. Different approaches have been used for monitoring blood pressure. European Society of Hypertension has recommended measurement for 7 days, twice in the morning and twice in the afternoon forhypertension self-management (HSM)[16]. In a study by NOHA morning and afternoon measurements were repeated three times[17].Nordmann has used a series of 30-day measurements[18].Cuspidi and Baily used 8 weeks of HSM in their studies [19],[20]. Most of these studies have reported high accuracy of this method for controlling, treatment and daily in these patients. A systematic review that was conducted by Gelin et al in 2010 on 72 clinical trials showed that self-monitoring of blood pressure have significantly decreased systolic (2.5) and diastolic (1.8) blood pressure .

For all the patients who need monitoring, telenursing is an appropriate tool for evaluation, monitoring and management of chronic diseases including hypertension. A study that was conducted in 2014 showed that one nurse could monitor 180 patients with chronic diseases in one day. Patients would upload their vital signs, weight and blood sugar at home through monitoring devices and the nurse would define the abnormal measurements and give the necessary information to patients for preventing undesirable conditions.

Different studies have shown the effectiveness of two methods of self-monitoring and telenursing in patients with different chronic diseases including high blood pressure and chronic respiratory diseases. In these studies different methods like phone calls, phone messaging and internet have been used which had different effects on patients' satisfaction, their rate of hospitalization, their admittance at hospitals and decrease in the complications of their disease. A clinical trial at the Tele Health Center showed a 45% decrease in the rate of mortality, 20% decrease in admittance to emergency wards, 14% decrease in elective hospitalizations and 14% decrease in the duration of

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hospitalization. Also the study of Watson et al in 2012 showed the positive effect of self-monitoring program on decreasing systolic and diastolic blood pressure.

However, the results of some studies have reported the above-mentioned methods not effect on controlling blood pressure. Kerry et al in 2013 showed that the decrease in the blood pressure of the intervention group was not significant compared to the control group. Considering the high prevalence of hypertension, not gaining desirable results in controlling blood pressure and presence of many patients at cardiology and neurology wards due to complications of hypertension, and also controversial results about blood pressure control through self-monitoring and telenursing and the importance of nurse's role in improvement of society's health and controlling non-communicable diseases like hypertension, the researcher conducted this study to evaluate the effects of two methods of self-monitoring and telenursing on changes in blood pressure of the intervention and the control group right after and 1, 2 and 3 months after the intervention and compare the results.

MATERIALS AND METHODS

This 3-group 4-stage clinical trial was conducted on 84 patients with high blood pressure who referred to Isfahan Hypertension Research Center in 2015-16. Sampling was performed from October 2015 to February 2016 on hypertensive patients who referred to this center with inclusion criteria. The inclusion criteria were being conscious, being able to communicate, being aware of their condition, being literate, being aged from 18 to 65 years old, having access to landline and cellphone, having mild or moderate hypertension, having a systolic and diastolic pressure of more than 140/90, being treated with at least one type of antihypertensive drug, having the mental and physical ability to participate in the study, not being pregnant or breastfeeding and not having a history of any severe cardiovascular event during the past 6 months. The exclusion criteria were patient's death, any changes in patient's condition which would make them unable to participate in the study and changes in patient's drugs.

The sample size was calculated to be 25 for each group using the following formula with a 95% confidence interval and 80% power; after considering 10% for sample loss, the sample size was raised to 28 for each group.

$$n = \frac{2S^2(Z_1 + Z_2)^2}{d^2} = \frac{2S^2(1.96 + 0.84)^2}{0.64S^2} = 25$$

At first, by simple sampling, samples were selected from patients who referred to the Isfahan Hypertension Research Center and had the inclusion criteria. Then using random table numbers, samples were allocated into three groups in a continuous method. The method was that 28 cards with number 1 on them, 28 cards with number 2 and 28 cards with number 3 were all put a closed pocket and the samples were asked to draw a card from the pocket. Those who drew number 1 where placed in the first group as the self-monitoring group, those with number 2 where allocated to the second group as the telenursing group and third group that was indicated by number 3 was he control group. Written informed consent was obtained from all the participants and systolic and diastolic pressure of them where measured. Demographic data, disease information and blood pressure checklist were filled by the researcher and their colleague who was not informed about the aims of the study, through questioning the participants of all three groups. After gathering the primary information, patients' phone number, cellphone number and home address were taken for further contacts.

In the telenursing group, at the study environment, patients' or one of their family members' cellphones were checked to have Farsi menu and the method of using messages was explained to them. For 12 weeks, every week 6 messages, which was a total of 72 messages, were sent to the participants. The messages included instructions about hypertension, physical activity, exercising and dieting, weight control, method of drug consumption, fatigue control, controlling chest pain, level of normal and social activities, treatment follow-up, stress control, quit smoking and controlling the level of blood pressure, glucose and lipids of blood. Participants of this group were asked to refer to Hypertension Research Center of Isfahan once a month for three months to measure their blood pressure. Eventually their blood pressure at the last day of the third month was measured and recorded.

Participants of self-monitoring group were trained how to use sphygmomanometer correctly during two 45-minute sessions. At first the right method of blood pressure measurement was trained to the patient in presence of one of their family members using a standard sphygmomanometer. Then, to make sure that they were trained correctly, the patients were asked to measure their blood pressure in the presence of the researcher and their errors were corrected,

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if any. It was agreed that participants of self-monitoring group would refer to Hypertension Research Center once a week at a specific day and time to measure their blood pressure in presence of one of their family members using the standard sphygmomanometer that was provided for them by the center and record their blood pressure in the blood pressure checklist.

Participants of the control group participated in 2 group sessions about high blood pressure. To not cut all the connections with this group, every two week, the researcher sent the patients a message through their cellphone and asked about their condition. Also they were asked to refer to the center once a month for 3 months two measure and record their blood pressure and weight.

Blood pressure was measured using OMRON digital device. Also the device was calibrated by the medical equipment technician at the beginning, in the middle and at the end of blood pressure measurement. For measuring the reliability of the device, blood pressure of 10 people were measured with it twice with a 5 minute interval and then by calculating the correlation coefficient of diastolic and systolic blood pressure, r = 0.79 was obtained.

Data were analyzed using SPSS 18 and qualitative (continuous and discrete) and quantitative (nominal and ordinal) were analyzed using Chi square test, one-way variance analysis, covariance analysis, variance analysis with repeated measures and kruskal-Wallis test.

Ethical considerations
This study has been approved by Research Chancellor of Isfahan University of Medical Sciences under No394604. The researcher explained the aims of the study for all the patients who referred to Hypertension Research Center of Isfahan and all the participants signed written informed consents before the study. The participants were assured of the confidentiality of their information.

RESULTS

Results showed that participants of all groups were statistically similar regarding their age, sex, job, monthly costs, educational level, marital status, BMI, history of hospitalization and the time passed from their diagnosis (p > 0.05).

Table 1: Comparing the frequency distribution of sex, marital status, employment status and history of hospitalization between the three groups of telenursing, self-monitoring and control

Table 2: Comparing the mean of systolic and diastolic blood pressure in participants of the three groups of telenusring, self-monitoring and control before and one, two and three months after the intervention

One-way variance analysis showed that the mean of systolic blood pressure of participants of all three groups had no significant difference before (p = 0.96) and one month after the intervention (p = 0.22). But the difference between the three groups was significant two months (p = 0.001) and three months (p = 0.001) after the intervention. Post hoc LSD test showed that the mean of systolic blood pressure was significantly higher in the control group two months after the intervention compared to the self-monitoring (p = 0.017) and telenursing (p = 0.001) groups.
Variance analysis with repeated measures showed that the mean of systolic blood pressure in the participants of the control group had no significant difference between different intervals (p = 0.17). But in the telenursing group (p < 0.001) and self-monitoring group (p = 0.001) the mean of systolic blood pressure had a significant difference between different intervals. Post hoc LSD test showed that the mean of systolic blood pressure in telenursing group had no significant difference before and one month after the intervention (p = 0.28) but two months after the intervention the mean was significantly lower than the first month and after the third month the mean was significantly lower than the second month (p < 0.001). In the self-monitoring group, the mean of systolic blood pressure was significant lower one month after the intervention compared to before the intervention (p < 0.001) and after the second month was significantly lower than the first month (p = 0.001) but the difference was not significant between two months and three months after the intervention (p = 0.17). One-way variance analysis showed that the difference between the mean of diastolic blood pressure of patients of the three groups was not significant before the intervention (p = 0.82) but their difference one month after the intervention (p = 0.001), two months after the intervention (p = 0.001) and three months after the intervention (p < 0.001) was significant. Post hoc LSD test showed that the mean of diastolic blood pressure one month after the intervention in the self-monitoring group was significantly lower than the control (p = 0.001) and telenursing (p = 0.005) groups and two months after the

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intervention, it was significantly higher in the control group than the self-monitoring (p < 0.001) and telenursing (p = 0.006) group. Post hoc LSD test also showed that the mean of diastolic blood pressure was significantly higher in the control group three months after the intervention compared to the self-monitoring and telenursing groups (p < 0.001).

Variance analysis with repeated measures showed that the mean of diastolic blood pressure in the patients of the control group had no significant difference between different intervals (p = 0.31), but the difference between the mean of diastolic blood pressure in the self-monitoring and telenursing groups was significant between different intervals (p < 0.001). Post hoc LSD test showed that the mean of diastolic blood pressure had no significant difference in telenursing group before and one month after the intervention (p = 0.10) but it was significantly lower two months after the intervention compared to one month after (p = 0.009) and significantly lower in the third month compared to the second month (p < 0.001). In the self-monitoring group the difference between the mean of diastolic blood pressure before and one month after the intervention was significant (p < 0.001) but the difference between the second month and the first month (p = 0.13) and between the third month and the second month was significant (p = 0.90).
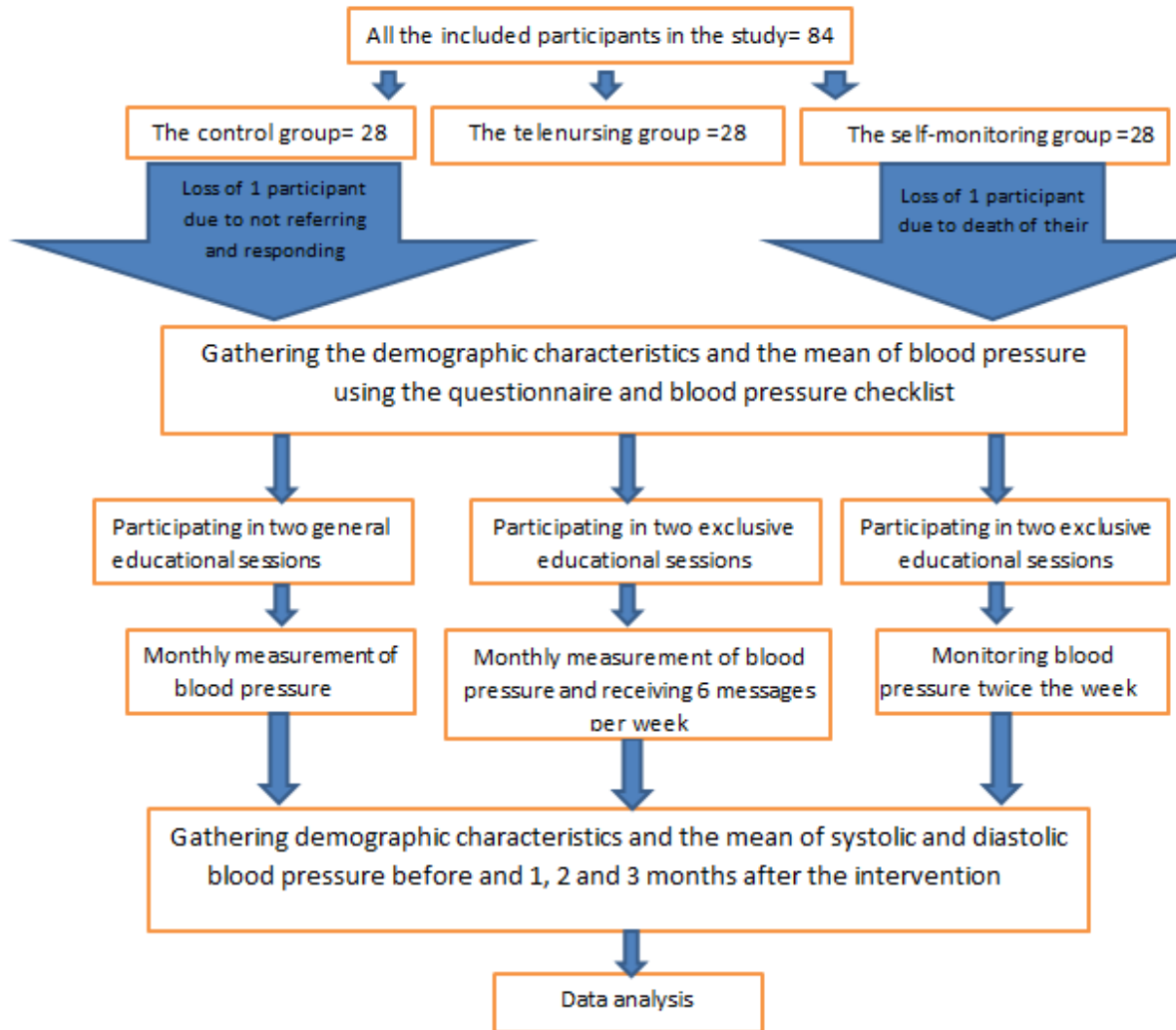
DISCUSSION

Results of the present study showed that self-monitoring and telenursing programs both have been effective in reducing the mean of systolic and diastolic blood pressure of the participants. Also telenursing in comparison to self-monitoring has been more effective in reducing the mean of systolic and diastolic blood pressure.

Study of Hayden et al showed that telenursing for 24 months could reduce the systolic and diastolic blood pressure of patients more than self-monitoring[30]. Acrogal et al in 2011 in a study revealed that using blood pressure telemonitoring could be more effective in reducing patients' high blood pressure compared to self-monitoring. Study of Ralston et al showed that during 12 months, 55% of monitored patients through web and phone were able to properly control their blood pressure (< 140/90). While only 37% of patients who used self-monitoring at home were able to control their blood pressure[31].Many studies have shown that self-monitoring could lead to a decrease in blood pressure[24, 32, 33,34,35].Angle et al in their study that was conducted in 2013 showed that blood pressure self-monitoring could decrease systolic and diastolic blood pressure to 18.7 and 8.5 mmHg[34].Uhliq et al mentioned that self-monitoring of blood pressure for 6 months could decrease systolic and diastolic blood pressure by 3.9 and 2.4 levels, respectively[35].A self-monitoring program reported the decrease in systolic blood pressure to be 10 mmHg and in diastolic blood pressure to be 5 mmHg; however the difference between the mean of changes in systolic blood pressure of the intervention and the control group was not significant. But the difference between the mean of changes in their diastolic blood pressure was significant[24].A study by Kerry et al in 2013 showed that the difference between the systolic blood pressure of the intervention group (blood pressure monitoring) and the control group was not significant but monitoring of blood pressure could reduce the blood pressure of patients with uncontrolled blood pressure. Decrease in the systolic blood pressure of the intervention and the control group was significant compared to the primary information. Also analyzing the subgroups revealed a relation between blood pressure measures and the disability caused by seizures[25].Blood pressure monitoring at home along with self-care caused a decrease in blood pressure of diabetes patients with uncontrolled blood pressure[32].Also Margolis et al in 2013 showed that telemonitoring of blood pressure along with medicinal management would increase the control of blood pressure[33].

Unlike the results of the present study, the study of McManus et al in 2005 in UK showed that self-monitoring of blood pressure for 6months had a little effect on patients' blood pressure and this effect was faded after 1 year[36].

Different studies have reported different results for self-monitoring and telenursing methods in controlling blood pressure; however the effect of using telemonitoring trough phone has been more obvious in decreasing systolic blood pressure (study of Chen and study of Kerry)[25,37,38,39,40,30]. Also a study in 2015 that was conducted by Kinstry et al reveled that telemonitoring of blood pressure would decrease patient's blood pressure[38].Study of Zullig et al in 2013 showed that telemonitoring through phone would decrease the blood pressure of hypertensive patients and increase their satisfaction[41].Also the study of Omboni et al in 2015 mentioned that telenursing and telemonitoring of blood pressure would lead to a proper control of blood pressure[40].Management of blood pressure at home by the patient or telemonitoring could decrease systolic and diastolic blood pressure of patients and be effective in controlling high blood pressure[8].Results of a study by Uhliq and Watson indicated the effect of

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self-monitoring in decreasing systolic and diastolic blood pressure; while the study of McManus did not report a positive result about self-monitoring method.

All the included participants in the study= 84

The control group= 28   The telenursing group =28   The self-monitoring group =28

Loss of 1 participant due to not referring and responding

Loss of 1 participant due to death of their

Gathering the demographic characteristics and the mean of blood pressure using the questionnaire and blood pressure checklist

Participating in two general educational sessions

Participating in two exclusive educational sessions

Participating in two exclusive educational sessions

Monthly measurement of blood pressure

Monthly measurement of blood pressure and receiving 6 messages per week

Monitoring blood pressure twice the week

Gathering demographic characteristics and the mean of systolic and diastolic blood pressure before and 1, 2 and 3 months after the intervention

Data analysis

Sampling, intervention and data gathering diagram

Although different studies have reported various effects for self-monitoring and telenursing in controlling blood pressure, one of the significant features of this study was the presence of one of patient's family members with them during educational sessions. Also during the intervention, samples would refer to the Research Center for blood pressure measurement along with a companion. In this study samples of the self-monitoring group measured their blood pressure twice a week and recorded it in blood pressure checklist. Also during the intervention, the telenursing group received educational messages through their cellphones. Also in this study samples were evaluated at 4 different times.

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Table 1: Comparing the frequency distribution of sex, marital status, employment status and history of hospitalization between the three groups of telenursing, self-monitoring and control

Variables	Groups	Tele-Nursing		Self Monitoring		Control		Chi-Square Test	
		Number	Percent	Number	Percent	Number	Percent	X2	P
Gender	Female	18	64.3	15	53.6	12	42.9	2.58	0.27
	Male	10	35.7	13	46.4	16	57.1		
	Total	28	100	28	100	28	100		
Marital Status	Married	26	92.8	25	89.3	25	96.2	6.52	0.37
	Single	1	3.6	2	7.1	0	0		
	Divorced	1	3.6	0	0	1	3.8		
	Death of Spouse	0	0	1	3.6	0	0		
	Total	28	100	28	100	28	100		
Job Status	Employee	2	7.1	3	10.7	3	10.7	26.7	0.70
	Free	5	17.9	8	28.6	10	35.7		
	Retired	5	17.9	4	14.3	4	14.3		
	Worker	0	0	1	3.6	1	3.6		
	Housekeeper	14	50	11	39.2	10	35.7		
	Others	2	7.1	1	3.6	0	0		
	Total	28	100	28	100	28	100		
History of Hospitalization	Has	14	50	16	57.1	17	60.7	0.67	0.71
	Does not Have	14	50	12	42.9	11	39.3		
	Total	28	100	28	100	28	100		

Table 2: Comparing the mean of systolic and diastolic blood pressure in participants of the three groups of telenusring, self-monitoring and control before and one, two and three months after the intervention

Time		Control Group		Tele-Nursing Group		Self Monitoring Group		One-Way Analysis of Variance (ANOVA) Test	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	F	P
Before intervention	Systole	145.71	14.70	145.18	10.33	146.07	11.33	0.038	0.96
	Diastole	88.93	7.50	87.86	5.99	88.11	6.39	0.20	0.82
First month of intervention	Systole	145.75	14.95	144.29	10.43	140	12.40	1.54	0.22
	Diastole	88.04	9.06	86.43	7.18	80.43	7.18	7.29	0.001
Second month of intervention	Systole	142.14	12.80	127.86	13.29	133.75	12.67	8.64	0.001
	Diastole	86.96	7.62	80.89	9.82	78.46	6.57	8.15	0.001
Third month of intervention	Systole	143.39	12.40	121.07	10.79	131.96	13.97	20.42	0.001
	Diastole	87.50	7.36	75.36	8.92	78.29	6.63	19.14	<0.001
Analysis of variance with repeated observations	Systole	F=2.85		F=68.11		F=57.71			
		P=0/17		P<0/001		P=0/001			
	Diastole	F=1/26		F= 20/53		F= 19/79			
		P=0.31		P<0.001		P<0.001			

CONCLUSION

According to the results of the present study, self-monitoring and telenursing could both be effective in controlling systolic and diastolic blood pressure of hypertensive patients. Therefore it is recommended that self-monitoring of blood pressure would become a part of patients' therapeutic program so that, after discharge from hospital, patients would take responsibility of controlling their disease with increased knowledge and improved attitude and prevent the relapse of the disease and more complications. This study also showed that educating patients through websites using the modern technologies could significantly decrease the number of hospitalization in patients and increase their satisfaction with telenursing method and also increase their motivation by getting support from a medical team to follow-up their therapeutic plan and continue their program.

Considering the high prevalence of hypertension, which has turned it into a serious health problem, providing programs for its appropriate prevention, control and treatment should be a health priority and using simple and low cost methods could have an effective role in controlling this disease. In this study, through a low cost program, the

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satisfaction of patients with executive methods was increased and positive changes in controlling patients' blood pressure were happened; so nurses, as the key members of health and treatment teams, which have the most communications with patients in the therapeutic environment, could use the results of this program for better control of hypertension and decreasing its consequences.

The most important limitation of this study was lack of time; in fact our limited time to perform this intervention within the limits of a thesis made us to fill the questionnaires in a short interval after the intervention. Therefore, for generalization of the results, it is recommended that further studies should be conducted with longer follow-up periods.

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