Original Article

Impact of Telenursing on Blood Pressure and Body Mass Index of People with Prehypertension: A Randomized Controlled Clinical Trial

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Abstract

Background: Prehypertension is an important global health challenge. This study determines the effect of telenursing on Blood Pressure (BP) and Body Mass Index (BMI) in patients with prehypertension. **Materials and Methods:** This randomized controlled clinical trial study included 81 patients with prehypertension discharged from an emergency room at Isfahan University of Medical Sciences (Iran) in 2016. Participants joined a session about hypertension, risk factors, and lifestyle modification to reduce its risk. Using a random number table, 41 subjects were assigned to the experimental group and 40 subjects to the control group. Only the experimental group received four SMS messages each week and a 10–15 min phone call once a month to help them change their lifestyle and reinforce their health behaviors. Eventually, patients' information was collected, and the data were analyzed using independent *t*, paired *t*, and Chi-square tests. **Results:** The experimental group after the intervention had a significantly lower mean (Standard Deviation [SD]) of Systolic Blood Pressure (SBP) (from 126.67 [5.15] to 119.21 [5.72] [$t_{40} = 8.40$, $p < 0.001$]) and Diastolic Blood Pressure (DBP) [from 85.28 (2.29) to 78.79 (4.16) ($t_{40} = 10.02$, $p < 0.001$)]. However, the same means were not significantly different in the control group [SBP ($p = 0.116$) and DBP ($p = 0.096$)]. The mean (SD) of changes between BMI before and after the intervention was -0.75 (0.66) in the experimental and 0.042 (0.41) in the control group, which was significantly different between the two groups ($t_{79} = -6.44$, $p < 0.001$). **Conclusions:** Telenursing can have potential benefits to maintain BP within the normal range and reduce BMI in patients with prehypertension.

Keywords: *Blood pressure, body mass index, hypertension, Iran, prehypertension, telenursing*

Introduction

Prehypertension is an important public health challenge globally. American Public Health Institute has added the Prehypertension group in a new classification of Hypertension (HTN) and considered high BP as a risk factor for cardiovascular diseases.[1-3] According to the new classification, people with Systolic Blood Pressure (SBP) between 120 to 139 mm Hg or Diastolic Blood Pressure (DBP) between 80 to 89 mm Hg are included in the prehypertension group or they are considered as individuals prone to HTN.[2] Prehypertension has a strong connection with increased HTN and cardiovascular diseases.[4] Individuals with prehypertension are at high risk for coronary vascular disease[5] and they are 1.7 times more than others likely to suffer from coronary artery disease.[6] Also, high BP is responsible for at least 45% of deaths due to heart disease and 51% of deaths due to stroke.[7] Some environmental factors such as obesity, high cholesterol levels, low physical activity, heart, kidney, and diabetes disease background can cause high BP.[8] Obesity is a prevalence of 20.8 and 63.6% among Iranian aged below and above 20 years, respectively.[9]

Furthermore, vital signs monitoring is an important nursing assessment.[10] Nurses have a fundamental role in the measurement and control of patients' vital signs, particularly in admitting patients and their treatment and release process. Using new technologies such as telenursing is one way to do so.[11] This method includes technologies such as telephone, Short Message Service (SMS), fax, internet, and audio and visual communication devices. Besides, using telephone and SMS is easy to access, cost-efficient, simplifies access to effective care, and improves the relationship between the patients and care providers.[12] Also, telenursing reduces the frequency of

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patients visiting clinics and their medical expenses while covering more patients and a wider geographical area. As a result, it reduces the expenses of human resources, time, and energy in health care systems.[13] With the increasing rate of HTN incidence and lack of caregiving personnel, nursing services need new methods to become more effective.

Moreover, continuous follow-up is another key part of the care service. Telephone follow-up is a useful and inexpensive method to assess the needs out-of-hours of patients' care. Plus, patients who have been followed, are more likely to change their inaccurate health behaviors.[14,15]

By the time of writing this study, there is no research study available to identify the effects of telenursing on BP and BMI in patients with prehypertension in Iran. However, similar research studies indicate that providing recommendations and health training through telenursing was effective for patients with asthma, myocardial infarction, and patients with implanted defibrillator, as well as lifestyle promotion for patients after stroke.[16-18] Also, opportunities for effective training before patients' discharge are rare. Therefore, this study aims to investigate the impact of telenursing on BP and BMI in patients with prehypertension, who are discharged from selected emergencies affiliated to Isfahan University of Medical Sciences (MUI) in Iran.

Materials and Methods

This study is a randomized controlled clinical trial conducted in 2016 (Trial Registration Number: IRCT201703127391N5). This research is a two-group study (control and experimental group). The samples were selected from men and female referred to Sahebalzaman hospital emergency in Shahreza, a medical center dependent on MUI. Based on the World Health Organization's STEPwise approach to Surveillance (STEPS), average SBP and DBP are calculated from 2 of 3 BP readings, taken 3 min apart.[19]

The inclusion criteria of this study included: 1–the average SBP during two measurements within 3 min was in the range of 120-139 or the average DBP was in the range of 80-89 in the right arm, 2–patients were discharged from the emergency department, 3–age range between 18 to 60 years old, 4–having access to a mobile phone and being able to use it, 5–being able to perform daily activities, read, and write, 6–not having HTN and not using BP reducer drugs, 7–not being on any special diet for obesity during the study, 8–being hospitalized in the emergency department and discharge less than 6 h, 9–not being pregnant and not lactating, and 10–not having diseases such as kidney failure and cancer. The exclusion criteria included: 1–lack of accountability in telephone communication more than three times, 2–unwillingness to continue the cooperation, 3–using any drugs during the study, and 4–using calming techniques such as yoga, meditation, confrontation with severe stress during the intervention period.

The sample size was calculated using information from similar studies.[13,20] According to the confidence level of 95% and test potency of 80%, the estimated sample size was 40 people. However, considering the possibility of 20% drop-offs, a total of 96 patients were selected (48 for the experimental group and 48 for the control group).

Data collection tools in this study included demographic data questionnaire (age, gender, marital status, employment status, education level, smoking, family history of HTN, hyperlipidemia, diabetes), and digitalis arm BP measurement device (Omron, M3 model, made in Japan), that its reliability and validity was confirmed at the beginning and during the study using arm mercury sphygmomanometer digital and mercury sphygmomanometers were compared and verified on 1-3 individuals on multiple occasions. A skilled researcher measured subjects' BP in a seated position and based on the World Health Organization standards for BP measurement.[21]

We used a digital scale (Soehnle, Nassau, Germany) for measuring the participants' weight in kilograms, whereas they were without shoes and wearing light-weight clothing. The same weight unit was used for all samples and its validity and reliability were confirmed every morning with a 5-kg calibrated weight and a plastic meter, which was calibrated with a metal meter and mounted on the wall. Also, BMI was calculated by dividing weight in kilograms by the square of his height in meters.[22] Informed written consent was signed by all the patients who passed the inclusion criteria and afterward, a demographic questionnaire was completed for the participants. Initially, all the participants attended a two-hour session regarding BP, HTN disease, risk factors, and lifestyle modification to reduce its risk (using lecture and PowerPoint) in 8 to 10 people groups. To validate the educational program, the researchers developed the content about HTN with help of experts, using available clinical guidelines, and a review of literature and studies on patients with prehypertension.

By using a random number table, participants were assigned to experimental and control groups based on even or odd numbers. They moved along the table in which the direction of movement had been already determined. In front of each person, a numbered cart was on the table. After opening this cart and based on the number, whether it was odd or even, the participants were allocated to control and experimental groups. Sample allocation continued until the sample size reached the predetermined number.

Moreover, the researcher's contact information was given to the experimental group, and contacting schedule was explained to the members. They could contact researchers between 8 a.m. to 8 p.m. They also received a phone call once a month and for 2 months (call duration was about 10–15 min).[20] The content of the phone calls was about determination and identification of HTN risk factors, reinforcement of patient's health behaviors, giving health recommendations, and investigating patients' needs. Plus, each week they received four messages (totally 32 messages) to change their lifestyle behaviors

such as proper physical activity, appropriate duration, repetition and type of exercise, restrictions on smoking, stress management, the importance of diet and its effect on BP especially the level of salt intake, the risks of weight gain, the effect of an increase in waist, abdomen and hip size, and proper BP measurement training.

There was no intervention for the control group during the 8 weeks of study on the experimental group. After this time, all participants were invited again to complete the questionnaire and to measure their weight and BP. At this point and as shown in Figure 1, seven patients in the experimental group (due to not answering the phone calls, unwillingness to continue cooperation, having other reasons such as traveling) and 8 patients in the control group (due to not answering the phone calls, unwillingness to continue cooperation) were excluded from the study. Finally, at the second stage, 41 patients remained in the experimental group and 40 patients in the control group. At the end of the study, all the text message consultations were given to the control group as an educational pamphlet.

Afterward, data were analyzed by using SPSS software program, version 16.0 (SPSS, Chicago, Illinois). The numerical variables were reported as mean (SD) and the non-numerical variables as number and percentage. Data were analyzed using independent t, paired t, and Chi-square tests. A value of $p < 0.05$ was considered statistically significant.

Ethical considerations

This study was approved by the Ethics Committee of Isfahan University of Medical Sciences under code IR.MUI.REC.1395.3. 234. After completion of informed consent forms, the patients were reassured that all information will be kept confidential and they were free to leave the study.

Results

The mean (SD) age in the experimental group was 39.39 (9.82) years and 40.52 (9.25) years in the control group. Information about both groups such as gender, education level, marital status, employment status, hyperlipidemia, diabetes, history of HTN in the family, and smoking are indicated in Table 1. Based on the Chi-square test, there was no significant difference between the two groups in terms of these characteristics. Hyperlipidemia and diabetes In experimental group were 9.80% (n = 4) and 9.80% (n = 4), respectively, and in control group were 12.50% (n = 5) and 7.50% (n = 3), respectively.

In Table 2, based on the Chi-square test, there was no significant difference between the two groups regarding the primary cause of referring to health centers and hospitalization in an emergency (p = 0.173). The main cause of referring to health centers among the experimental group was weakness and dizziness (14 [34.10%]) and pain among the control group [13 (32.50%)].

In Table 3, based on the paired t test, mean (SD) SBP (t_{40} = 8.40, $p < 0.001$) and mean (SD) DBP (t_{40} = 10.02, $p < 0.001$) of the experimental group before and after the intervention was significant. Mean (SD) SBP (p = 0.116) and mean (SD) DBP (p = 0.096) of the control group before and after the intervention showed no significant difference. Based on the independent t test, before the intervention, there was no statistically significant difference in mean (SD) SBP (p = 0.631) and mean (SD) DBP (p = 0.290) between the two groups. However, after the intervention, there was a statistically significant difference in mean (SD) SBP (t_{79}= –6.55, p = 0.001) and DBP (t_{79}= –6.04, p = 0.001) between two groups. According to the findings of the study, SBP mean (SD) difference before and after intervention in the experimental group was 8 (4.88) mm Hg and 1.98 (1.63)

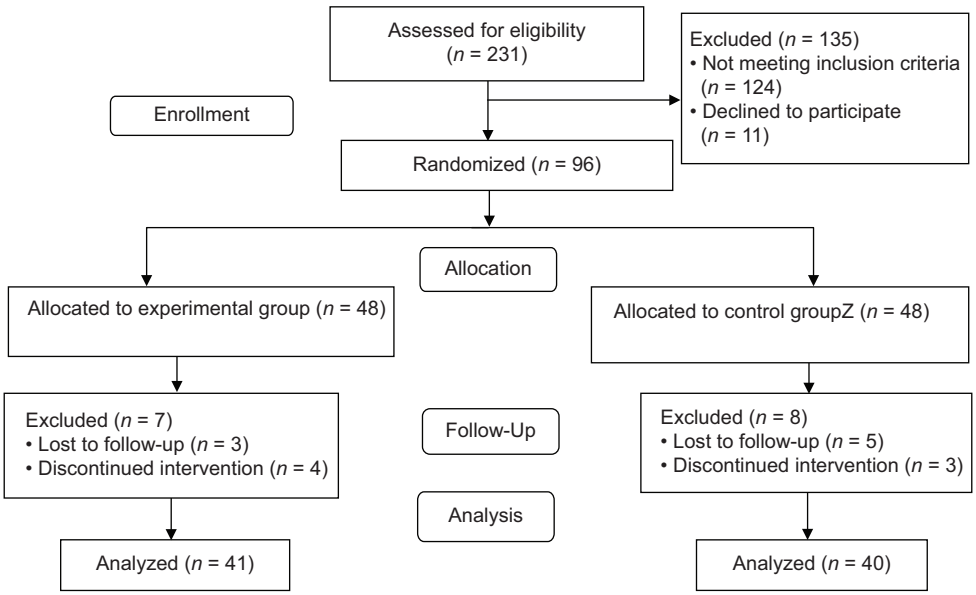

Figure 1: Consort flow diagram of the participants

Table 1: Comparison of demographic variables in the experimental and control groups

Demographic characteristics and underlying diseases	Situation	Experimental group n (%)	Control group n (%)	Chi-squared test	
				F	*p*
Gender	Female	21 (51.20)	18 (45.00)	0.31	0.575
	Male	20 (48.80)	22 (55.00)		
Educational level	0-5	16 (39.00)	20 (50.00)	2.37	0.305
	6-12	18 (43.90)	11 (27.50)		
	>12	7 (17.10)	9 (22.50)		
Marital status	Married	36 (87.80)	36 (90.00)	0.90	0.753
	Single	5 (12.20)	4 (10.00)		
Occupation	Employed	17 (41.10)	22 (55.00)	1.67	0.642
	Retired	2 (4.90)	1 (2.50)		
	Homemaker	20 (48.80)	15 (37.50)		
	Student	2 (4.90)	2 (5.00)		
Hyperlipidemia	Yes	4 (9.80)	5 (12.50)	0.15	0.694
	No	37 (90.20)	35 (92.50)		
Diabetes	Yes	4 (9.80)	3 (7.50)	0.13	0.718
	No	37 (90.20)	37 (92.50)		
Family history of hypertension	Yes	16 (39.00)	15 (37.50)	0.20	0.888
	No	25 (61.00)	25 (62.50)		
Smoking	Yes	6 (14.60)	8 (20.00)	0.41	0.523
	No	35 (85.40)	32 (80.00)		

Table 2: Comparison of reference cause frequency distribution in two studied groups

Reference cause	Experimental group n (%)	Control group n (%)	Chi-squared test	
			F	*p*
Pain (head, chest, abdomen)	7 (17.10)	13 (32.50)	7.71	0.173
Weakness and dizziness	14 (34.10)	6 (15)		
Fever	4 (9.80)	3 (7.50)		
Respiratory problems	6 (14.60)	4 (10)		
Endocrine problems	0 (0.00)	2 (5)		
Digestive problems	10 (24.40)	12 (30)		
Total	41 (100)	40 (100)		

Table 3: Comparison of systolic and diastolic blood pressure and Body Mass Index before and after intervention in both studied groups

Variable	Time	Groups		t	*p* value****
		experimental Mean (SD)	Control Mean (SD)		
SBP* (mm Hg)	Before the intervention	126.67 (5.15)	126.09 (5.70)	0.48	0.631
	after the intervention	119.21 (5.72)	126.72 (4.51)	-6.55	<0.001
	t	8.40	-1.60		
	p value*****	<0.001	0.116		
Changes in mean (SD) SBP		8.00 (4.88)	1.98 (1.63)	7.39	<0.001
DBP** (mm Hg)	Before the intervention	85.28 (2.29)	84.67 (2.79)	1.06	0.290
	after the intervention	78.79 (4.16)	83.91 (3.40)	-6.04	<0.001
	t	10.02	1.70		
	p value*****	<0.001	0.096		
Changes in mean (SD) DBP		6.58 (3.98)	2.01 (2.10)	6.43	<0.001
BMI*** (kg/m2)	Before the intervention	26.00 (3.43)	25.90 (3.83)	0.133	0.895
	after the intervention	25.25 (3.36)	25.94 (3.64)	0.87	0.382
	t	7.24	-0.65		
	p value*****	<0.001	0.520		
Changes in mean (SD) BMI		-0.75 (0.66)	0.04 (0.41)	-6.44	<0.001

*systolic blood pressure; ** diastolic blood pressure; *** body mass index. **** resulted from independent t test. ***** resulted from Paired *t* Test

mm Hg in the control group. Also, DBP mean (SD) difference before and after intervention in the experimental group was 6.58 (3.98) and 2.01 (2.10) mm Hg in the control group. Besides, based on the independent *t* test, mean (SD) changes of SBP ($t_{79} = 7.39$, $p < 0.001$). and DBP ($t_{79} = 6.43$, $p < 0.001$) in both groups was significant. Based on the paired *t* test, mean (SD) BMI (($t_{40} = 7.24$, $p < 0.001$) before and after the intervention in the experimental group was significant, whereas in the control group there was no significant difference ($p = 0.520$). Based on the independent *t* test, there was no statistically significant difference in BMI ($p = 0.895$) before intervention between the two groups, as there was no significant difference between the two groups after the intervention ($p = 0.382$). The mean (SD) of changes between BMI before and after intervention in the experimental group was –0.75 (0.66) and in the control group was 0.042 (0.41), which based on independent *t* test was significantly different between two groups ($t_{79} = -6.44$, $p < 0.001$).

Discussion

Comparison of demographic data and disease information of both control and experimental groups before the study revealed that participants of both groups were statistically similar. Based on the results, the prevalence of hyperlipidemia and diabetes among all participants was high. In a cross-sectional study about the prevalence of HTN in adults in Isfahan city, the prevalence of diabetes among women was 9.7% and 8.1% among men. In addition, the prevalence of hyperlipidemia among women was 17.4% and 14.9% among men.[23]

The results of the present study show that after the intervention, there was a significant difference in mean (SD) SBP and DBP between experimental and control groups. In addition, SBP and DBP mean (SD) difference in both groups was significant and it decreased more in the experimental group. This is because understanding a new type of relation and training helped patients become more motivated, causing them to increase self-care and contact health providers more often. Likewise, a study reported that after telephone consultation, the reduction of the mean (SD) SBP and diastole in the experimental group after the intervention was significantly more than the control group. In this study, the experimental group has a verbal training session, and has received nursing consultation through SMS and telephone calls for 8 weeks, and compared to the control group, it had a significant impact on the reduction of SBP and diastole after the intervention.[24] In another study, obtained results showed that in a group, which was under two behavioral management interventions by nurse and doctor, and BP monitoring, reduction of SBP after 12 months (14.8 mm Hg) was significant, and also reduction of DBP in this group after 18 months (5.3 mm Hg) was significant.[25]

The results of another study, despite a larger sample size and longer duration of telephone follow-up, are consistent with the results of this study in terms of a significant reduction of SBP in the experimental group. In this study, in a group that received the simultaneous intervention of BP monitoring at home and telephone follow-up, the reduction of SBP was statistically significant compared to the group with usual care, although despite the reduction of DBP, it was not statically significant compared to usual care group.[26] These studies showed that telephone follow-up by nurses has positive effects on BP control and is worth considering for the management of chronic diseases such as HTN.

Based on our results, mean (SD) BMI in both groups before and after the intervention was not different significantly. But the mean (SD) BMI before and after intervention in the experimental group decreased by 0.75, which is statistically significant. In order to reduce BMI, more time, care, and education about losing weight are needed. Despite the limited duration of this study, this method showed a significant effect on BMI after the intervention. In a study about the impact of telenursing on controlling glycemic and BMI, no significant difference was found in BMI between the experimental and control groups. In their view, a reason for this lack of meaningful difference is more time required for patients' education and care, as well as the requirement for more duration study to change BMI.[13]

Another study, with the aims to investigate the impact of telenursing on glycated hemoglobin and anthropometric indexes in patients with type II diabetes, found that the mean (SD) BMI before and after intervention between two groups was significant after 3 months of telephone intervention (The mean [SD] BMI of 28.19 [5.29] reduced to 27.28 [5.19]). In this study, after intervention in the experimental group and based on paired *t* test, a statistically significant difference was found.[27]

The limitation of the present study was the short follow-up time after the intervention due to the limited time available for performing the student thesis. Therefore, it is suggested that further studies should be conducted in this respect with longer follow-up duration. Another limitation of this study that is also present in all other studies, is that the diagnosis of prehypertension was based on BP measurements made during only one day. However, the strengths of this study include using standard conditions to measure BP, height, and weight, and having a proper sample size.

Conclusion

According to the results of this study, diligent consultations using mass communications can reduce the costs and is cost-effective. Also, it may have potential benefits to maintain BP within the normal range, control SBP, DBP, and reduce the BMI of people with prehypertension. In addition, multiple nursing tasks, and their working congestion in an emergency, and opportunities for effective training of patients before their discharge are rare. Therefore, identification of cardiovascular risk factors and training these patients are not conducted completely. However, telenursing has been helpful in solving this problem.

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Conflicts of interest

Nothing to declare.

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