

## ORIGINAL ARTICLE

# A Comparison between The Effectiveness of Short Message Service and Reminder Cards Regarding Medication Adherence in Patients with Hypertension: A Randomized Controlled Clinical Trial

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### ABSTRACT

**Background:** Hypertension is increasing rapidly in developing countries. Today, modern technologies are suggested as the tools used to enhance medication adherence. This study aimed to compare the effectiveness of short message service (SMS) to reminder cards with regard to medication adherence in patients with hypertension.

**Methods:** The present study is a randomized controlled clinical trial. The subjects consisted of 123 patients with hypertension at the clinical-educational center of Sayyed-Al Shohada, Urmia, who met the study criteria. Selected based on the convenience method, the samples were randomly divided into three groups: the SMS group, the reminder-cards group, and the control group. The subjects in the SMS group were sent 6 text messages a week for three months, and the subjects in the reminder-cards group were trained in how and in what order to use their cards. Hill-Bone medication adherence scale was completed by all the participants before and three months after the intervention. Data analysis was performed in SPSS software, using one-way ANOVA.

Hill-Bone medication adherence scale was completed by all the participants before and three months after the intervention. Data analysis was performed in SPSS software, using one-way ANOVA.

**Results:** The results of ANOVA test demonstrated that the mean scores of medication adherence were statistically different among the three groups of control (46.63±2.99), SMS (57.70±2.75) and the reminder cards (57.51±2.69) after the intervention ( $P<0.001$ ). However, after the intervention the means of the patients' medication adherence scores were not statistically different between the two groups trained via SMS and reminder cards ( $P>0.05$ ).

**Conclusion:** The findings of the present research demonstrated that training and distance-monitoring via SMS and reminder cards promote medication adherence of patients. Therefore, healthcare teams and nurses are recommended to apply such training methods.

**Trial Registration Number:** IRCT2015110917059N2

**KEYWORDS:** Hypertension; Medication adherence; Reminder system; Short message service

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## INTRODUCTION

A global medical challenge, hypertension can cause a variety of disorders in one's organs, especially the heart.<sup>1</sup> Despite the many advances in the treatment of hypertension, there are still many unanswered questions in the pathology of the disorder; in 90 to 95 percent of patients, the cause of hypertension cannot be diagnosed.<sup>2</sup> Hypertension is a prevalent disorder worldwide, with approximately 73 million American adults suffering from the disease.<sup>3</sup> According to the latest statistics of world health organization (WHO), hypertension has affected more than one-third of the world's population over 25 years.<sup>4</sup> Likewise, in Iran many studies report the incidence of hypertension to be high; in 2006, Delavari et al. reported that 25.31 and 26.05 percent of men and women in Iran suffer from hypertension, respectively.<sup>5</sup> In a national research in 2004, the incidence of hypertension in urban and rural areas was found to be 30.5 and 29.2 percent, respectively.<sup>6</sup>

Heart diseases are the the leading cause of death in patients with hypertension.<sup>7</sup> It is estimated that by 2030, 23 million people will have lost their lives due to hypertension-related cardiovascular diseases.<sup>4</sup> The incidence of brain stroke caused by high blood pressure (especially in people over 65) is rapidly increasing.<sup>7</sup> Moreover, prolonged hypertension can, by damaging the renal veins, cause kidney failure and, if left untreated, lead to death.<sup>8</sup>

By medication adherence, patients can avoid the serious consequences of hypertension. Medication adherence will not only prevent the occurrence of subsequent problems, but can control and treat the disease in its early stages. On the other hand, failure to adhere to one's medication is one of the most serious barriers to achieving the positive results of treatment plans.<sup>9</sup> Medication adherence can be defined as following the dietary and medicine instructions or the lifestyle recommended by the providers of clinical care.<sup>10</sup> In the case of patients with hypertension, adherence includes sticking to the recommended diet,

exercising, medication, and monitoring and recording one's blood pressure.<sup>11</sup>

On average, 65 to 75 percent of patients follow the diets recommended by their care providers; however, only 45 to 55 percent of those with chronic diseases such as hypertension included adhered to their diets.<sup>9</sup> In developing countries, medication adherence has been found to be even less (50 percent), and only 30 to 50 percent of patients with hypertension have been reported to observe their treatment plans.<sup>10</sup> Poor medication adherence prevents the patients from achieving the goals of their treatment plans and, ultimately, form recovery. An incomplete recovery process, in turn, results in frequent visits to medical centers, reduction in the quality of life of patients, and an increase in medical costs.<sup>11</sup>

Even though considerable amounts of time and energy are spent for diagnostic measures, most patients ignore or only partially follow the medical diets they are instructed to follow.<sup>2</sup> Among the factors that affect the patients' adherence are demographic characteristics, severity of disease, complexity of drug regimen (number of drugs and daily doses prescribed), drug classes (due to tolerability and side effects to medication), patients' forgetfulness and lack of understanding about the nature of the disease.<sup>12</sup> In another retrospective cohort study on variance in adherence among hypertensive patients, it was found that the factors that had the strongest positive effect on adherence included duration of hypertension (better adherence in patients with shorter duration) and the use of newer agents.<sup>13</sup> In view of the direct consequences of hypertension and patients' poor medication adherence, it is necessary to educate the patients on the nature of hypertension, the urgency of seeking medical care, and the importance of adherence to the recommended medication.<sup>14</sup> A wide range of different strategies and interventions have been used to support the patients in adherence to treatment plans, although the results are not consistent.<sup>15</sup> Reducing the number of daily doses appears

to be effective in increasing adherence to blood pressure treatment plans.<sup>16</sup> Methods of encouraging patients to stick to the administration of the drugs prescribed include: motivational interview, family support, daily- or weekly-graded reminder boxes, recording one's own blood pressure, and simplification of the patients' medical regimens.<sup>10</sup>

Today, such new technologies as text messaging are suggested as ways to enhance medication adherence. To increase the patients' adherence to their treatment plans, text messages can be sent daily or weekly to maintain a one-sided or interactive (asking and answering questions) relationship with patients and remind them to take their medication.<sup>17</sup> Text messaging, one of the simplest and most popular functions of mobile phones, can provide the patients with access to the information they need at any time and place; moreover, compared to other forms of information technology, e.g. the Internet, mobile phones are easier to use.<sup>18</sup> Two trials in Spain with short follow-up periods have explored the efficacy of SMS-based interventions for people with hypertension to improve treatment compliance and blood pressure control. Although the trials' results suggest the potential for small to moderate effect sizes in improved compliance and blood pressure control, the effects were not statistically significant.<sup>15</sup> However, despite the many advantages of text messaging, errors are also inevitable; messages may not be received due to technical failure, a patient's cell-phone may be off, or a message may be ignored.<sup>18</sup>

Another method for monitoring the patients after discharge is using reminder systems: tools which patients are provided with at discharge. There are various forms of reminder systems, such as electronic systems and reminder cards.<sup>19</sup> Reminder cards are simple educational tools which are easy to use and very common. The cards can result in greater attention to treatment-related hygienic and clinical matters and effectively remind the patients of their instructions; however, since reminder cards are more costly than sending

text messages in patient education, they are approached with caution.<sup>20</sup> By encouraging self-care and medication adherence, reminder packages can improve the treatment process.<sup>21</sup> However, this system has its own shortcomings, such as the patients' forgetting about the educational package, failure to use it at the right time, using the reminder cards all at once and disregarding them during the rest of one's treatment.<sup>19</sup> Long-term blood pressure control requires integrating the medication into daily life to support adherence and persistence on treatment.<sup>15</sup> Therefore, the present study aimed to compare the effectiveness of text messaging with that of reminder cards in medication adherence in the case of patients with hypertension referring to the clinical-educational center of Sayyed-Al Shohada, Urmia, in 2013.

## MATERIALS AND METHODS

This is a randomized controlled clinical trial study with a pretest-posttest design, conducted at the governmental clinical-educational center of Sayyed-Al Shohada, affiliated with Urmia University of Medical Sciences. The data were collected from April to October 2013. The inclusion criteria for this study were: age between 20-60 years, literacy, expert confirmation of uncontrolled hypertension, being on medication for hypertension, living in the city of Urmia, having access to a mobile phone, being able to use the text messaging function (reading and composing a text message), not being on medication for prostate in the male patients, and willingness to participate in the study. The exclusion criteria were: being hospitalized in the duration of the study, unwillingness to participate further, moving to another city, being permanently treated for hypertension, and loss of contact with the patient through his/her mobile phone.

Sample size was calculated using power sample size calculator (SSC) software and the results of a previous study conducted by Strandbygaard et al. in which  $\mu_1$ , and  $\mu_2$  were respectively equal to 86.6, 60.8.<sup>22</sup> Then, with

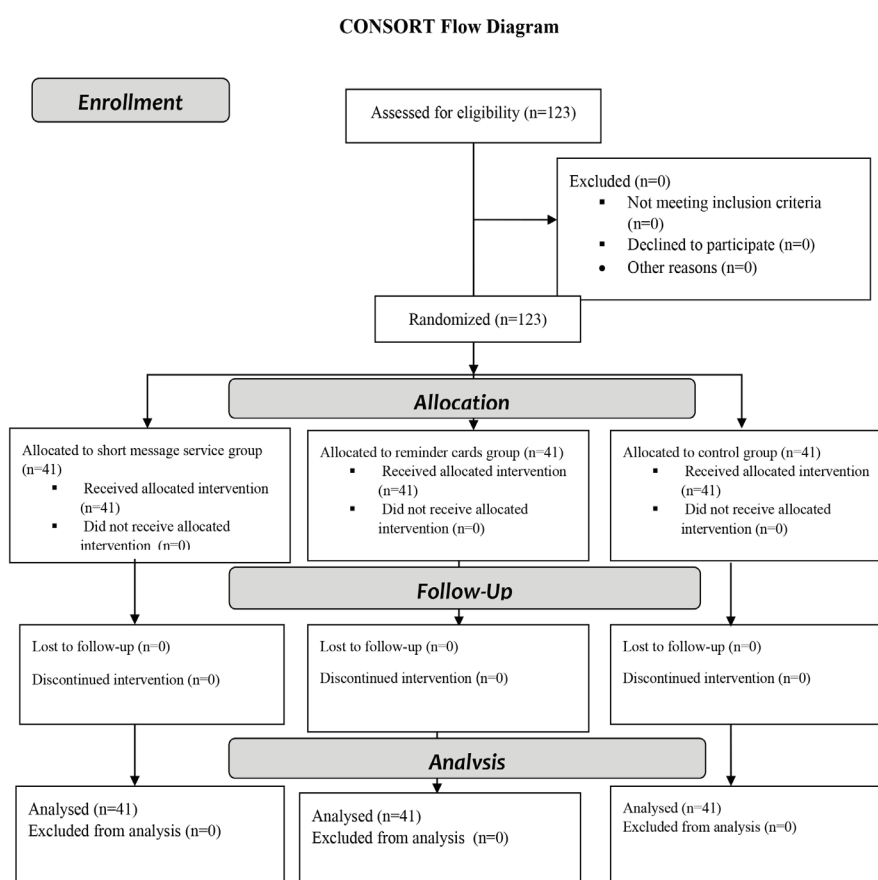
a type I error of 0.05 and a power of 0.80, the sample size was estimated to be 41 patients for each group. In total, 123 patients participated in the study. Sampling was based on the convenience method. In this study allocation concealment was observed, and the patients were randomly divided into three groups: each patient was asked to choose a card from a pack of cards of three different colors green, red and yellow; those with a green card were assigned to the text messaging group, the red cards were assigned to the control group and the yellow cards were assigned to the reminder cards group. The patients had not been informed of the significance of colors and the researchers until the allocation of patients to three groups they did not know which patient will be in which group (Figure 1).

The study was approved by the research deputy and the research ethics committee of Urmia University of Medical Sciences with the code number of 1525. To begin the study, the researcher explained the objectives to

the patients and all the participants signed a written informed consent before participation in the study. The questionnaires were anonymous and all of the participants were assured about the confidentiality of their personal information. The participants were free to withdraw from the study at any time. The researchers observed all ethical issues in accordance with the latest version of Helsinki ethical declaration.

The data collection instrument used by the researchers was the Hill-Bone Compliance to High Blood Pressure Therapy Scale, as developed by Kim et al. in 2000.<sup>23</sup> The questionnaire consists of 14 questions which fall into three categories: medication adherence, treatment regimen adherence, and medical appointments adherence. Each item was a four-point Likert scale: never (1), occasionally (2), often (3), and always (4); the maximum and minimum possible scores were, respectively, 56 and 14.

This scale has been validated in many



**Figure 1:** Design and protocol of the study

investigations, among which in a South African primary health care setting. Lambert et al. have verified the criterion validity and internal consistency of the Hill-Bone Scale; their results were compared favorably with those from an urban African-American setting (Standardized Cronbach's alpha was 0.74–0.84).<sup>24</sup> In their study, Taher et al. confirmed the validity of the scale based on the content validity approach and under the supervision of 12 faculty members at Shahid Beheshti School of Nursing; moreover, the reliability of the scale was confirmed by calculating the Chronbach's alpha coefficient of the scores of 20 patients with hypertension; the alpha was found to be 0.8.<sup>25</sup> Likewise, the reliability of the Hill-Bonescale has been verified by Ashktorab et al., who found the Cronbach's alpha of the scale to be 0.71.<sup>26</sup> In the present study, the content validity of the scale was verified by 10 nursing faculty members and 5 cardiovascular specialists, and the reliability of the instrument was calculated to be 0.81, 0.84, 0.79, 0.91 respectively for total adherence to treatment, medication adherence, treatment regimen adherence, and medical appointments adherence based on the value of the Cronbach's alpha.

All the questionnaires were filled out through individual interviews in a private room at the clinical-educational center of Sayyed-Al Shohada. A trained interviewer who was blind to the patients' groups conducted all the interviews. After completing the questionnaires, 123 patients were randomly assigned into three groups including control, short messaging and reminder cards groups by block randomization.

Intervention for the reminder cards group consisted of education in the appropriate usage and ordering of the cards. The patients in the text messaging group were sent 6 messages a week. Both groups were presented with the same educational content, which fell into four domains: medication adherence, treatment regimen, physical activities, and blood pressure monitoring. The patients in the control group received the standard education

of the clinical center. The intervention lasted for 3 months. The patients were expected to inform the researchers if they failed to check their blood pressure or had to visit the clinical center again in the duration of the intervention. Also, all the patients were asked to visit the clinical center on alternate weeks (6 times in total during the 3-month intervention) and have their blood pressure checked for free. The patients in the text messaging group could text the researchers if they had any questions about the educational messages they were sent. At the end of the intervention, the patients were asked to visit the clinical center and complete the compliance scale again.

Statistical analyses were conducted using SPSS software (Version 20; SPSS Inc, Chicago, IL). The normality of data was determined using the Kolmogorov–Smirnov test, as well as skewness and kurtosis values. All the tests conducted were two-tailed. The alpha level of significance for all inferential statistics was set at 0.05. Differences in adherence scores between the groups were tested using ANOVA.

## RESULTS

The ANOVA and Chi-square test results showed that the qualitative variables of gender, marital status, occupation, education, income, hypertension familial history and smoking and the quantitative variables of age and body mass index (BMI) among the three groups were not significantly different (Table 1).

Before the intervention, the mean adherence to treatment and its dimensions (adherence to diet, drug regimen and follow-up medical appointments) scores in the three groups of control, text messaging and reminder cards had no statistically significant differences ( $P > 0.05$ ). However, the mean scores of adherence to treatment and its dimensions (adherence to diet, drug regimen, and follow-up medical appointments) after the intervention increased in the text messaging and reminder cards groups, compared to the control group. Individual one-way ANOVA

**Table 1:** Comparison of demographic characteristics in three groups

Variable	Category	Control group	Text messaging group	Reminder Cards group	Chi-square test result
		N (%)	N (%)	N (%)	
Gender	Woman	29 (70.7)	27 (65.9)	31 (75.6)	X <sup>2</sup> =0.943 df=2 P=0.624
	Man	12 (29.3)	14 (34.1)	10 (24.4)	
Marital Status	Single	1 (2.4)	1 (2.4)	0 (0)	X <sup>2</sup> =1.469 df=4 P=0.832
	Married	38 (92.7)	38 (92.7)	40 (97.6)	
	Divorced	2 (4.9)	2 (4.9)	1 (2.4)	
Occupation	Unemployed	2 (4.9)	1 (2.4)	0 (0)	X <sup>2</sup> =6.052 df=6 P=0.417
	Employee	5 (12.2)	9 (22.0)	3 (7.3)	
	Housewife	27 (65.9)	24 (58.5)	30 (73.2)	
	Retired	7 (17.1)	7 (17.1)	8 (19.5)	
Education Level	Primary	23 (56.1)	20 (48.8)	20 (48.8)	X <sup>2</sup> =6.607 df=6 P=0.339
	Secondary school	6 (14.6)	11 (26.8)	9 (22.0)	
	High school	9 (22.0)	4 (9.8)	10 (24.4)	
	College graduate	3 (7.3)	2 (4.9)	6 (14.6)	
Income	Adequate	17 (41.5)	29 (70.7)	22 (53.7)	X <sup>2</sup> =7.177 df=4 P=0.127
	Somewhat sufficient	20 (48.8)	10 (24.4)	16 (39.0)	
	Insufficient	4 (9.8)	2 (4.9)	3 (7.3)	
Smoking	Yes	4 (14.3)	14 (50)	10 (35.7)	X <sup>2</sup> =8.755 df=4 P=0.068
	No	35 (38)	26 (28.3)	31 (33.7)	
	Former smokers	2 (66.7)	1 (33.3)	0 (0)	
<b>Variable</b>		<b>Mean±SD</b>	<b>Mean±SD</b>	<b>Mean±SD</b>	<b>ANOVA test result</b>
Age (year)		50.54±8.14	53.68±6.94	50.29±10.51	P=0.307
BMI		27.64±3.61	28.79±6.22	27.33±2.96	P=0.146

tests for the three groups showed statistically significant differences between the mean scores of adherence to treatment and its dimensions among the three groups after the intervention ( $P < 0.001$ ) (Table 2).

Tukey's post-hoc test showed that after the intervention, the mean score of adherence to treatment for patients in the control group ( $46.63 \pm 2.99$ ), compared with the two groups of text messaging ( $57.70 \pm 2.75$ ) and reminder cards ( $57.51 \pm 2.69$ ), showed a statistically significant difference ( $P < 0.001$ ). But the mean score of adherence to treatment for the patients in the two intervention groups did not show a statistically significant difference ( $P = 0.667$ ).

## DISCUSSION

The results of the study showed that the three groups were not significantly different in terms

of their demographic profiles: gender, marital status, occupation, educational level, income, age and BMI. Therefore, the statistically significant differences in the dependent variables between the control, text messaging, and reminder cards groups can be attributed to the effectiveness of the interventions in those groups. The results of the present study show that the adherence to treatment mean scores before the intervention in the three groups of control, text messaging, and reminder cards were not significantly different; in other words, all the three groups were homogeneous in adherence to treatment.

Moreover, the results showed that the mean of the three groups' treatment adherence scores in the three areas of adherence to diet, drug regimen, and follow-up of medical appointments increased significantly, which proves the effectiveness of distance learning through the methods of text messaging and reminder cards. Da Costa et al. reported

**Table 2:** Comparison of the mean scores of adherence to treatment and its dimensions among the three groups before and after the intervention

Time	Variables	Control group	Massage Service group	Remainder Cards group	ANOVA test result
		Mean±SD	Mean±SD	Mean±SD	
Before the intervention	Follow the diet	10.19±1.18	10.58±1.11	10.24±1.79	P=0.382
	Tracking drug regimen	31.58±2.40	30.56±3.39	31.41±2.45	P=0.209
	Follow-up medical appointment	28.78±2.31	32.17±1.20	32.09±0.94	P=0.723
	Adherence to treatment	52.78±3.65	51.46±5.08	52.75±5.27	P=0.264
After the intervention	Follow the diet	10.04±1.11	11.65±0.52	11.46±1.00	P<0.001
	Tracking drug regimen	5.53±0.86	5.60±1.04	5.68±0.98	P<0.001
	Follow-up medical appointment	5.48±0.86	6.73±0.89	6.65±0.76	P<0.001
	Adherence to treatment	46.63±2.99	57.70±2.75	57.51±2.69	P<0.001

significant differences in adherence between patients with hypertension who used a reminder alarm card that produced a beep at predetermined times, and patients who did not.<sup>19</sup> Andrade et al. found that an electronic reminder device with audiovisual reminders significantly improved adherence in memory-impaired patients (assessed with neuropsychological tests), but not in memory-intact patients.<sup>27</sup> On other hand, four studies, which measured the impact of the reminder on multiple time points, showed no effects on adherence at any time point.<sup>28-31</sup> Also, Hou et al.'s study revealing no effect used standardized messages without requesting a reply.<sup>28</sup>

Moreover, the results showed that the increase in treatment adherence did not differ significantly between the two intervention groups; this can mean that the two approaches used in the present study were equally effective in encouraging treatment adherence. Education plays an important role in enhancing treatment adherence.<sup>32</sup> The study of Beune et al. confirms the positive impact of education on treatment adherence in patients with hypertension.<sup>33</sup>

The findings of a study showed an increase in the mean scores of the intervention groups in the area of treatment regimen adherence, and a decrease of the same score in the control group, which proves the efficacy of the educational methods used. In his study, Thomas rated the adherence of patients with heart failure to their regimens as good,<sup>34</sup> however, Albert reports

that regimen adherence in patients with a chronic cardiovascular disease ranges between average and satisfactory.<sup>35</sup> Educating patients in food regimens, exercising and a healthy lifestyle can reduce the risk factors and the consequences of cardiovascular diseases.<sup>36</sup>

The statistical results of the study demonstrated an increase in the patients' drug regimen adherence as a result of the researchers' education. On the other hand, in the case of the control group, who did not undergo any interventions, the results showed a decline in the patients' adherence to their drug regimen. The results also revealed that text messaging was a more effective way to enhance the patients' drug regimen adherence: it can be concluded that the daily-sent text messages had acted like an alarm, reminding the patients of the time to take their medicine. Quoting Ingersoll and Cohen, a review study of 76 works of research showed that treatment adherence in patients with a chronic disease increased significantly after the intervention.<sup>37</sup>

The results of the study also indicated that, after the intervention, the intervention groups had higher scores for adherence to medical appointments than did the control group. According to the statistical results, text messaging has been a more effective way to enhance the patients' adherence to their medical appointments and periodic visits for monitoring their diseases and medication regimens. In his study entitled "Improving medication adherence in patients with a

chronic cardiovascular disease”, Albert concludes that patients’ adherence to their treatment plans increases after education; this conclusion is in the same line with the results of the present study.<sup>35</sup> Alongside the effective educational methods employed in the study, the nurses’ regular follow-up inquiries should also be considered as a factor contributing to treatment adherence. Their other advantage is that they can be employed without need for a large staff; it is even possible to use a mass texting service to send out thousands of educational messages daily.

This study was conducted on a small number of patients. Moreover, the duration of follow-up and the interval between the intervention and outcome assessment were short in this study. Then replication of the same study with larger sample size and longer follow-up and longer interval between the intervention and outcome assessment is suggested. Secondary outcome, on the other hand, the blood pressure of patients, in this study was not reported that is the limitation of this study.

## CONCLUSION

According to the findings of the present study, text messaging and reminder cards can encourage the patients to adhere to their treatment plans. Nowadays, due to the increasing prevalence of hypertension and its serious consequences, as well as the difficulty of making regular visits to medical centers for patients with chronic diseases to be educated and monitored, the methods of text messaging and reminder cards are suggested as helpful and effective approaches. The low cost of text messaging and reminder cards prompt us to recommend these two options. It is suggested that similar studies be done on patients with other chronic diseases.

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**Conflict of Interest:** None declared.

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