Effect of Weekly Text Messaging Reminders on Medication Adherence in Hypertension and Type 2 Diabetes Mellitus at a Tertiary Care Center in Eastern Nepal

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Citation

Sarraf DP, Rauniar GP, Gupta PP, Maskey R, Kattel V. Effect of Weekly Text Messaging Reminders on Medication Adherence in Hypertension and Type 2 Diabetes Mellitus at a Tertiary Care Center in Eastern Nepal. *Kathmandu Univ Med J.* 2023;82(2):185-9.

ABSTRACT

Background

The short-message service (SMS) reminder techniques are found to be important in increasing medication adherence in non-communicable diseases.

Objective

To assess the effect of SMS on medication adherence in hypertension and/or type 2 diabetes mellitus.

Method

An observational study was conducted in the outpatient department using a semi-structured questionnaire. Patients having hypertension and/or type 2 diabetes mellitus and taking at least one medication and having low to medium adherence were enrolled and short-message service was sent to them twice a week for up to two months reminding them to take medications as prescribed. At the end of two months, medication adherence was assessed using SPSS at P-value less than 0.05.

Result

Out of 105 patients, 64 (60.95%) were females. The mean age (±SD) was 51.15 ± 11.01 years. After two months of the short-message service reminders, majority of the patients were graded as having high adherence (73.33%) followed by medium adherence (20.0%) and low adherence (6.67%). The mean medication adherence scores on day one and after two months were 5.50 ± 1.14 and 7.50 ± 0.93 respectively (P-value=0.000). A high medication adherence was seen in individuals aged above 45 years (75.7%), males (78.0%) and those using a basic mobile phone (76.7%) after two months of follow-up; however it was statistically not significant (P-value > 0.05).

Conclusion

The SMS reminders had significantly improved the medication adherence in patients with hypertension and/or type 2 diabetes mellitus. However, none of the baseline variables were significantly associated with improvement in the adherence.

KEY WORDS

Hypertension, Medication adherence, Text messages, Type 2 diabetes

INTRODUCTION

Poor adherence to the medications in patients with chronic diseases like hypertension and type 2 diabetes mellitus is a global problem.[1,2] Patients with poor medication adherence in hypertension are at greater risk for coronary disease, cerebrovascular disease and chronic heart failure.[3,4] Similarly, poor medication adherence in type 2 diabetes mellitus makes achieving good glycemic control difficult, which is believed to affect the onset of diabetic microangiopathy (retinopathy, nephropathy and neuropathy) and increase the risk of other complications.[5]

The increase in cellular phone usage drives the suitability of text messages reminders as almost all Nepalese people have their own cellular phone of some kind.[6] Reminders through short message services (SMS) might be innovative, less costly and effective methods for improving medication adherence. The objective of the study was to assess the effect of SMS reminders on medication adherence in hypertension and type 2 diabetes mellitus.

METHODS

It was an observational study. It was conducted in the outpatient department of General practice and Emergency Medicine (GPEM) and Department of Internal Medicine, B.P. Koirala Institute of Health Sciences (BPKIHS), Dharan, Nepal from January to April 2022. The study considered 95% confidence interval (CI) and 80% power to estimate the sample size. In an Indian study, majority of the study participants with low adherence moved toward high adherence (88.4%) at follow-up after receiving messages for 2 months.[7] Therefore, Prevalence (p) = 88.4.

Compliment of p (Q) = 100-p=11.6

Z=1.96 at 95% CI; L= 15% of p at 80% power=13.26

$n=z^2XpXq/L^2 \rightarrow 91$;

Adding 10% to the calculated sample size to reduce various biases, the sample size became 100.

Inclusion criteria:

i. Patients with hypertension and/or type 2 diabetes and taking medications for at least 3 months

ii. Patients attending the outpatient department

iii. Patients with Eight-Item Morisky Medication Adherence Scale (MMAS-8) score less than 8

iv. Patients having age 18 to 70 years

v. Patients capable of using mobile phone

vi. Patients capable of reading text messages in Nepali language

vii. Patients giving consent to participate in the study

Exclusion criteria:

i. Patients with schizophrenia, bipolar disorder, dementia or mental retardation, HIV/AIDS

ii. Patients not using mobile phone

Non-random convenience sampling method was used. A semi-structured questionnaire was used to collect the relevant data. It consisted of three sections: (A) socio-demographic and clinical characteristics [age, gender, occupation, marital status, educationa level, residence, types of mobile phone (smartphone ot basic mobile phone), duration of disease, duration drug treatment]; (B) Eight-Item Morisky Medication Adherence Scale (MMAS-8) for assessing the medication adherence.[8] Permission was taken from the author to use the scale. It consisted of eight items with binary scoring for the first seven items (Yes=0, No=1) and a five-point Likert score for the last item which contributes a score 1 or zero (1 for 'never' and zero for other responses). The scores ranged between 0 and 8 with high a score indicating high adherence. It was pretested in 10% of the study population and by consulting with the subject experts to establish validity and reliability. The sample used for pilot testing was not used for the final data analysis. The study was approved by Nepal Health Research Council, Kathmandu, Nepal (Reference number: 1427/2021).

The purpose of the study was explained to the patients and then written informed consent was taken. The baseline MMAS-8 score was obtained at the first visit; then SMS was sent to the participants twice a week for up to two months reminding them to take medications as prescribed. At the end of two months, the MMAS-8 score was again recorded. The details of participant recruitment is shown in figure 1. A basic mobile phone was defined as one having only calling and sending text messages functions. A smartphone was defined as one having all kinds of extra functionalities, like internet access, the option of downloading apps, and a camera.

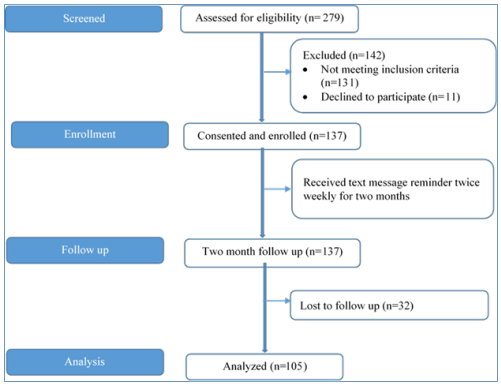

Figure 1. Flowchart of participation of patients in this study

The data were entered into Microsoft Excel 2010. The descriptive statistics like mean, standard deviation (SD), frequency and percentage were calculated. The patients

were categorized in three categories: low (score < 6), medium (score 6-7), and high adherence (score 8) based upon the MMAS-8 score. Non-categorical variables were analyzed using Chi-square test. Continuous data were analyzed with Student's t test. P-value less than 0.05 was considered statistically significant. Statistical Package for Social Science (version 11.5) was used for the statistical analysis.

RESULTS

A total of 105 patients (76 patients from Department of Internal Medicine and 29 patients from GPEM) participated in the study. Sixty-four patients (60.95%) were females and 44 (41.90%) were in the age group of 46–60 years. Mean age (± SD) of the patients was 51.15 ± 11.012 years. Thirty-nine (37.14%) patients had hypertension and 34 (32.38%) patients had both hypertension and type 2 diabetes. Majority of the patients were using smartphone (71.41%), followed by basic mobile phone (28.57%) (Table 1).

Table 1. Socio-demographic characteristics of the patients (n=105)

Variables		Frequency	Percentage
Gender	Male	41	39.05
	Female	64	60.95
Age category (years)	29 – 45	35	33.33
	46 – 60	44	41.90
	61 – 70	26	24.76
Type of mobile phone	Basic phone	30	28.57
	Smartphone	75	71.43
Diagnosis	Hypertension	39	37.14
	Type 2 diabetes	32	30.48
	Both	34	32.38
Co-morbidities	Hypothyroidism	10	9.52
	Dyslipidemia	5	4.76
Occupation	Employed	35	33.33
	Homemaker	51	48.57
	Unemployed	19	18.10
Educational level	Below class 10	73	69.52
	Class 10 and above	32	30.48
Residence	Sunsari	86	81.90
	Others	19	18.10

A total of 206 drugs were prescribed to 106 patients and metformin (28.64%) was the most common drug prescribed followed by Amlodipine (13.11%) and Losartan (6.8%) (Fig. 2).

Majority of the patients (72.38%) were prescribed one to two drugs followed by three to four drugs (25.71%) and five or more drugs (1.9%). Majority of the patients were on drug therapy for six to ten years (23.81%) followed by less than one year (16.19%) (Fig. 3).

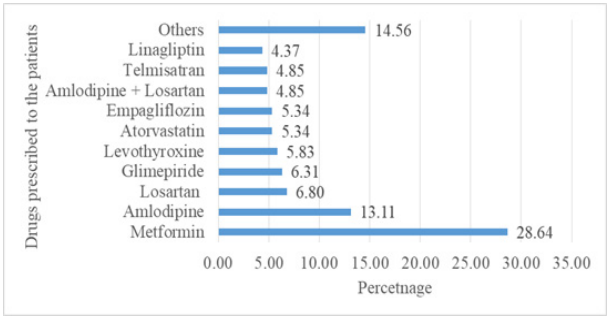

Figure 2. Drugs prescribed to the patients (n=206)

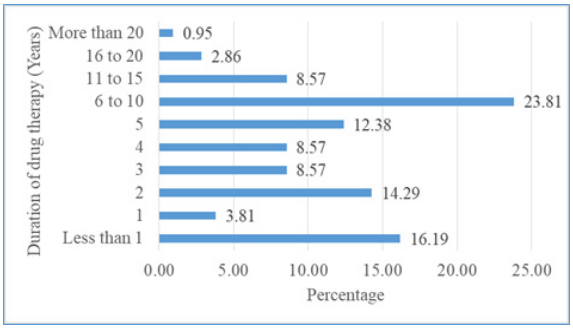

Figure 3. Duration of drug therapy in patients (n=105)

The patients were graded as having poor (47.6%) to medium adherence (52.4%) for their medicines consumption based on the Morisky Medication Adherence Scale-8 (MMAS-8) on day one. After two months of the SMS reminders, majority of the patients were graded as having high adherence (73.33%) followed by medium adherence (20.0%) and low adherence (6.67%) (Fig. 4).

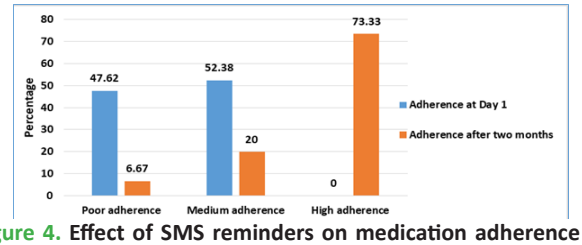

Figure 4. Effect of SMS reminders on medication adherence in the patients (n=105)

Mean medication adherence scores at day one and after two-months of follow-up were 5.50 ± 1.14 and 7.50 ± 0.93 respectively and it was statistically significant (P-value < 0.0001, Paired sample t test). After two-months of follow-up, high medication adherence was seen in the patients aged above 45 years (75.7%), the males (78.0%) and those using basic mobile phones (76.7%); however, it was statistically not significant (P-value > 0.05). At the end of two-months follow up, the patients with both diabetes and hypertension were highly adherent (82.4%) as compared to the patients having either hypertension (71.8%) or diabetes (65.6%); however, it was statistically not significant (P-value=0.618). Co-morbidities (P-value=0.677), educational level (P-value=0.968), residence (P-value=0.520), numbers of drugs taking (P-value=0.716) and duration of drug therapy (P-value=0.120) had no statistically significant differences on the medication adherence after the two-months' follow-up (Table 2).

Table 2. Level of medication adherence based on the socio-demographic characteristics associations after two months' follow-up (n=105)

Baseline variables		Medication adherence after two months, n (%)			Total n (%)	P-value
		High	Medium	Low		
Age	<45	24 (68.6)	8 (22.9)	3 (8.6)	35 (33.3)	0.718
	45 or more	53 (75.7)	13(18.6)	4 (5.7)	70 (66.6)	
Gender	Male	32 (78.0)	7 (17.1)	2 (4.9)	41 (39.1)	0.665
	Female	45 (70.3)	14(21.9)	5 (7.8)	64 (60.9)	
Type of mobile phone	Basic phone	23 (76.7)	7 (23.3)	0 (0.0)	30 (28.6)	0.213
	Smart-phone	54 (72.0)	14(18.7)	7 (9.3)	75 (71.4)	
Diagnosis	Hyper-tension	28 (71.8)	8 (20.5)	3 (7.7)	39 (37.1)	0.618
	Diabe-tes	21 (65.6)	8 (25.0)	3 (9.4)	32 (30.5)	
	Both	28 (82.4)	5 (14.7)	1 (2.9)	34 (32.4)	
Co-morbid-ities	Pres-ent	9 (64.3)	4 (28.6)	1 (7.1)	14 (13.3)	0.677
	Absent	68 (74.7)	17(18.7)	6 (6.6)	91 (86.7)	
Occu-pation	Em-ployed	25 (71.4)	8 (22.9)	2 (5.7)	35 (33.3)	0.856
	Others	52 (74.3)	13(18.6)	5 (7.1)	70 (66.7)	
Educa-tional level	Below class 10	53 (72.6)	15(20.5)	5 (6.8)	73 (69.5)	0.968
	Class 10 and above	24 (75.0)	6 (18.8)	2 (6.3)	32 (30.5)	
Resi-dence	Sunsari	65 (75.6)	16(18.6)	5 (5.8)	86 (81.9)	0.520
	Others	12 (63.2)	5 (26.3)	2(10.5)	16 (18.1)	
Num-ber of drugs	1 - 2	55 (72.4)	15(19.7)	6 (7.9)	76 (72.4)	0.716
	> 2	22 (75.9)	6 (20.7)	1 (3.4)	29 (27.6)	
Dura-tion of drug therapy (years)	< 5	36 (66.7)	12(22.2)	6(11.1)	54 (51.4)	0.120
	5 or more	41 (80.4)	9 (17.6)	4 (2.0)	51 (48.6)	

DISCUSSION

Medication non-adherence is a global health-related problem in patients with non-communicable diseases (NCD).[9] The key determinants of non-adherence are socioeconomic status, interaction among patient and prescriber, follow-up, severity of diseases, polypharmacy, adverse drug reactions, literacy of the patients, motivation and social support.[10,11] A report suggests that 8% of global health expenditure can be saved by improving medication adherence to the prescribed drugs.[12] Interventions directed through mobile in the form of text messages for managing NCD like hypertension and diabetes hold strong potential for improving medication adherence and help in bringing innovation to health care.[13] The present study had assessed the effect of SMS reminders on the medication adherence in patients with hypertension and/or type 2 diabetes mellitus. Majority of the patients (60.95%) were females in the present study. It might be due to the sex differences in body composition and fat deposition.[14] Again, most of the patients (41.9%) were in the age group of 46-60 years and similar finding was also reported by Shukla et al. (38%).[7] Risk factors like smoking and alcohol consumption among men and women aged 50 years and older puts the patients at risk of NCDs like hypertension and type 2 diabetes mellitus.[15-17] Educational intervention regarding risk factors of hypertension and type 2 diabetes mellitus should be planned to make the females as well as males more aware so that they can start living a healthy life-style as the most important part of treating chronic diseases is to change the lifestyle of the patients.

It was interesting to find out that after SMS reminders at day 60, the level of medication adherence significantly improved and majority of the patients were graded as having high adherence (73.33%). This was in concurrence to Shukla et al. (88.4%) and Varleta et al. (62.3%).[7,18] Mean adherence score increased from 5.50 ± 1.145 (at day one) to 7.50 ± 0.932 (at day 60) and was statistically significant (P-value < 0.0001); however, no statistically significant differences were found among either of the co-morbidities, educational level, residence, numbers of drugs taking or duration of drug therapy (P-value > 0.05). The text-message reminders might have addressed the patients' forgetfulness, emphasizing the importance of taking drugs as prescribed and also might have an impact on motivation to the patient. The findings of the present study supported the mobile health medication reminder technology that can be utilized by health-care professionals to enhance medication adherence. A study by Patel et al. had reported that mobile-phone based medication reminder system contributed positively to improving medication adherence in hypertensive patients in the USA in 2012.[19] Similarly SMS reminders improved adherence of type 2 diabetes patients in a study in the Netherlands.[20] Mobile phone has become a significant part of our life and most of people. As majority of people living in Nepal use smart mobile phones, healthcare professional can utilize weekly SMS reminder to the patients to take their medicines as prescribed that can have a huge impact on improvement on the medication adherence. Cognitive behavioral therapy, interviews by trained healthcare professionals and counseling and motivation are some of the other techniques that can be used to improve the adherence to the medications in various chronic diseases as well.[12]

The present study had clearly demonstrated an improvement in medication adherence following regular text message reminders about the importance of regular intake of medicines. Improved medication adherence has a significant effect on blood pressure control in hypertension and glycemic control in type 2 diabetes mellitus.[21,22] Text message reminders through mobile phones can be used in

ambulatory patients care settings and easily implemented in routine clinical practice to help patients take their medications as prescribed and our study findings supported this. The results from the present study contributed to an empirical foundation for future interventions on the patient-centric android mobile application on medication adherence in chronic diseases. We expect that the study findings would help the physicians, nurses, other healthcare workers and policy-makers to intervene for increasing medication adherence in chronic diseases. There is a large scope to avail mobile phone applications to improve the medication adherence so that the health benefits of the prescribed medicines in non-communicable diseases can be maximized. The clinicians should use automated messaging system as a reminder for medication adherence to the patients in chronic diseases for better clinical outcome. It would be better to incorporate such system into the universal health system.

The present study had some limitations. Duration of the study was short. The patients were followed up only for two months; therefore, the persistence to the medication adherence would not be guaranteed beyond two months' study period. However, the findings of the present study represents an underutilized resource in primary care that would improve medication adherence and potentially have a huge impact on patient care.

CONCLUSION

The present study had clearly demonstrated that SMS reminders had significantly improved the medication adherence in the patients with hypertension and type 2 diabetes mellitus. Further study can be planned to examine the effect of SMS reminder on medication adherence over a longer period of time to determine if the persistence occurs. The effectiveness of patient-centric android mobile application on medication adherence in hypertensive and diabetic patients can also be further explored.

ACKNOWLEDGEMENT

We acknowledge the Nepal Health Research Council for providing a provincial grant and ethical clearance for the study. We would like to thank Mr. Dharani Dhar Baral sir for statistical analysis. We thank the study participants for their valuable participation in this study.

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