

ADHERENCE LEVEL AND BLOOD SUGAR CONTROL OF TYPE 2 DIABETES MELLITUS PATIENTS WHO GETS COUNSELING AND SHORT MESSAGES SERVICE AS REMINDER AND MOTIVATION

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ABSTRACT

Objective: Examines the effects of counseling and short messages service (SMS) as a reminder and motivation toward medication adherence improvement and controlled HbA_{1c} levels of type 2 diabetes mellitus (T2DM) patients.

Methods: This study used a quasi-experimental method with prospective data retrieval. The subjects of this study were 40 patients with outpatient T2DM in internal disease polyclinic in West Nusa Tenggara Hospital, Indonesia. Patients who fulfilled the inclusion criteria were divided into two groups: The control group (n=20) receiving only the drug care service and the treatment group (n=20) receiving counseling and SMS reminder and motivation from the pharmacist. Data collecting was conducted using the pill count method, and HbA_{1c} levels were taken from the medical record.

Results: The results showed that counseling and SMS as reminder and motivation by a pharmacist can improve treatment adherence significantly ($p < 0.05$) by 11.33 ± 8.47 and can decrease HbA_{1c} level significantly ($p < 0.05$) of 1.32 ± 0.72 in the intervention group. There was a positive correlation between T2DM patient treatment adherence to HbA_{1c} levels ($r = 0.254$, $p = 0.023$).

Conclusion: The provision of counseling and SMS as a reminder and motivation by the pharmacist can have a positive effect toward medication adherence and control of HbA_{1c} in T2DM patients.

Keywords: Treatment adherence, HbA_{1c}, Type 2 diabetes mellitus, Counseling, Short messages service.

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INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder disease with characteristics of hyperglycemia that occurs due to insulin secretion abnormalities, insulin function, or both [1]. According to the International Diabetes Federation, Indonesia is ranked tenth of the highest number of people with DM in the world [2]. According to data from the Basic Health Research report in 2013, the prevalence of diabetes in Indonesia, especially in West Nusa Tenggara based on an interview which diagnosed by a doctor was 0.9% [3].

The level of adherence of patients in taking medication is one of the factors that determine the success of therapy, especially for chronic diseases such as DM [4]. As for the barrier factors that affect patient adherence is the length of therapy, the complexity of the regimen, poor communication between patients and health workers, lack of information, the perception of benefits, safety, side effects, medical expenses, and psychological factors [4,5]. In addition, non-adherence to the treatment of type 2 DM (T2DM) patients is also due to a lack of knowledge and awareness of patients about the importance of medication adherence in diabetes management [6]. One way to improve adherence to treatment is the existence of an intervention from pharmacists in the form of education. Previous research has shown that pharmacist education and counseling of diabetic patients can improve knowledge, attitude, and practice and medication adherence, and control of fasting blood sugar levels [7]. Education by pharmacists through short messages service (SMS) given for 30 days can improve medication adherence and blood sugar control of patients with T2DM [8].

Pharmacist intervention is in the form of education and counseling, even motivation in the form of reminder system (SMS) has been

developed in Africa to improve antiretroviral adherence [9]. In addition, research conducted by Ginanjar *et al.* (2013) showed that pharmacist interventions given through counseling and SMS as reminders and motivations can improve treatment adherence and controlled blood pressure of hypertensive patients [10]. Based on this, research is necessary to be conducted to determine the effect of pharmacist interventions through counseling and SMS as a reminder and motivation for HbA_{1c} adherence and control of T2DM patients.

METHODS

This research was conducted prospectively with a quasi-experimental design. The study was conducted at West Nusa Tenggara Hospital during April-July 2017. The inclusion criteria were T2DM patients received oral antidiabetics at least 6 months before adherence measurement, HbA_{1c} before and after treatment, the age of 45-65 years old, were able to access the mobile phone and can read SMS. Exclusion criteria are deaf patient, pregnant patient, and patients who are unwilling to engage in research. The subjects included in the inclusion criteria and volunteered for the study (after obtaining informed consent) were divided into two groups: Control and treatment groups. The control group received conventional counseling from the hospital pharmacist while in the treatment group received counseling and reminder SMS and motivation from the researcher (Fig. 1). Counseling was done on the first visit (pre-study) and SMS reminder and motivation is given 15 times until the second visit (post-study). We ensure that all participants in this study can read SMS. Some examples of SMS reminders and motivations are presented in Table 1.

Data collection was done by interview regarding the suitability of the number of drug taken and the number of prescribed drugs (pill count). Percent adherence was calculated using the following equation:

Table 1: Content of SMS

Type SMS	Content of SMS given	Frequency of giving SMS	Number of SMS
Drug reminder and motivation	"Good morning miss/Sir, how are you? Hopefully, you are fine. Have you prepared your medicines this morning, to keep your health take your medication, control your routine schedule, exercise, eat healthy food?. Your health is very valuable for your family. Thank you"	1-7 th day	7
Motivation	"Take the medicine on time and doing physical activity for at least 30 min every day will help you control blood sugar and prevent complications"	8 th , 15 th , 22 nd , and 29 th day	4
	"Diabetes is a serious disease but can be easily controlled by reducing excessive carbohydrate consumption and having healthy lifestyle"	9 th , 16 th , 23 rd , and 30 th day	4

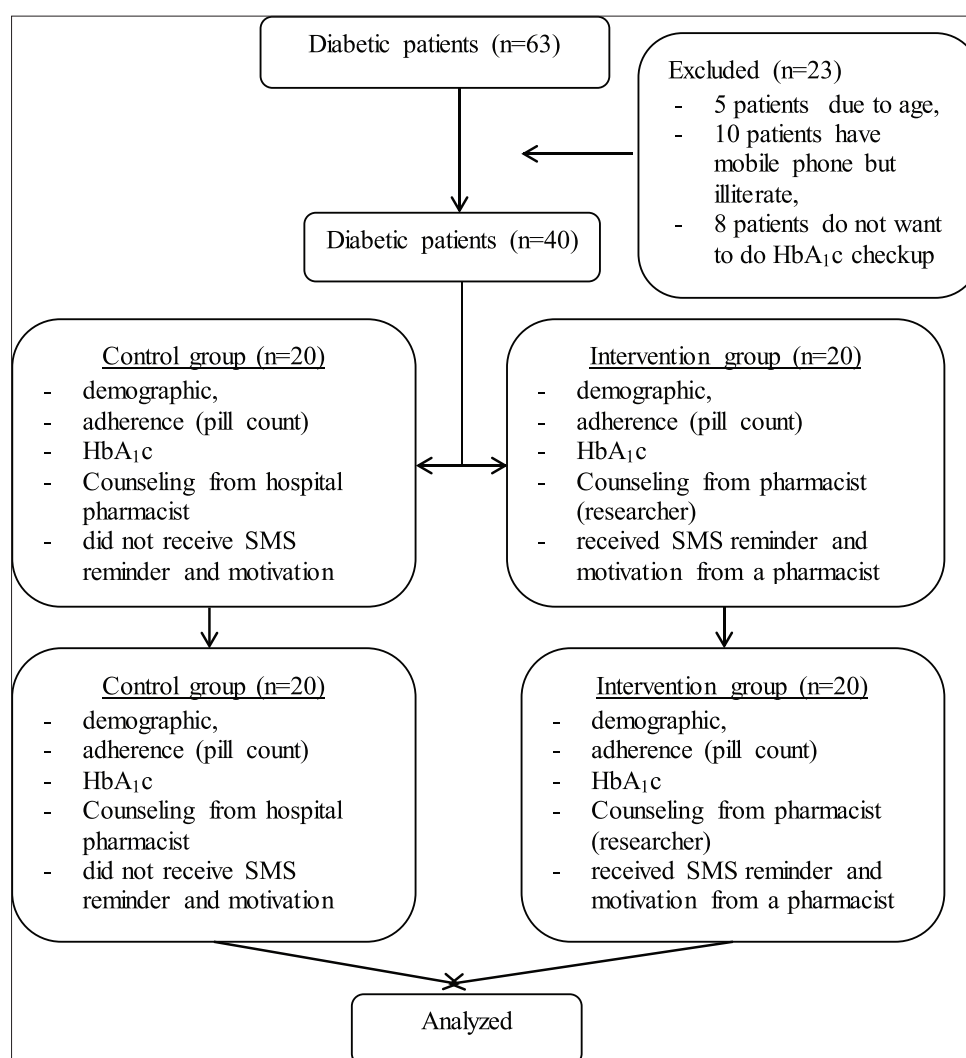


Fig. 1: Flowchart of study participants

(Number of tablets taken/number of tablets that should have been taken) ×100. If an overuse occurs, the percentage of patient adherence is calculated from the ratio between the numbers of drug consumed minus the amount of excess drug consumed by the amount of drug that should be consumed ×100%. Estimates derived using the dispense date were compared with those obtained using the start date as

reported by the client. Overall adherence was estimated by averaging the adherence estimates for each medication the subject was taking. To facilitate analyses, when overuse was observed we subtracted the number of extra tablets from the number of tablets that should have been taken and this figure was used in the numerator. To determine the representativeness of the subject's average adherence estimate,

the proportion of all medications counted per subject was calculated. From the calculation results, it will be obtained two categories that if the calculation results <80% including non-adherence category and if the calculation results in 80-100% including adherence category [11]. This research has been approved by the ethics committee of West Nusa Tenggara Hospital, Indonesia, with the number 070.1/17/KEP/2017.

Statistic analysis

The data obtained were analyzed using SPSS 16.00. Statistical analysis used to process the data of different respondent characteristics using independent sample t-test, pre- and post-study data were conducted using paired sample t-test, while to analyze the relationship between adherence with HbA_{1c} using Pearson correlation test. $p < 0.05$ was considered statistically significant.

RESULTS

The subjects included in the inclusion criteria as 40 patients were divided into the control group (n=20) and the treatment group (n=20). The control group received the usual care counseling from the hospital pharmacist, while the treatment group received counseling and reminder and motivation SMS. Data result of the respondent characteristic can be seen in Table 2.

Characteristics of respondents by sex ($p=0.557$), occupation ($p=0.505$), education ($p=0.886$), age ($p=0.837$), duration of treatment ($p=0.422$), treatment ($p=0.794$), and HbA_{1c} ($p=0.616$) showed $p > 0.05$, it shows that there was no significant difference between both groups of control and treatment. By gender, the majority of respondents in the intervention group were women (65%) while in the control group the majority was male (65%). Based on occupations, the majority of respondents worked, both in the intervention group (80%) and control group (90%). The dominant education in the intervention group was the elementary school up to high school (60%) while in the majority of the control group had education at university (55%). The dominant age was at age ≥ 50 years in both the intervention group (90%) and the control group (60%). The duration of treatment was < 5 years in the intervention group (55%), whereas in the control group had the same percentage of < 5 years and ≥ 5 years (50%). The dominant treatment was combination therapy both in the intervention group (80%) and control group (80%). The average level of HbA_{1c} in the intervention group was 8.29 ± 0.68 and in the control group was 8.16 ± 0.87 .

Table 2: Baseline characteristics of participants

Characteristics	Intervention group (%)	Control group (%)	p
	n=20	n=20	
Gender			
Male	7 (35)	13 (65)	0.557
Female	13 (65)	7 (35)	
Occupation			
Working	16 (80)	18 (90)	0.505
Jobless	4 (20)	2 (10)	
Education level			
Up to senior high school	12 (60)	9 (45)	0.886
Undergraduate	8 (40)	11 (55)	
Age			
< 50 years	2 (10)	8 (40)	0.837
≥ 50 years	18 (90)	12 (60)	
Treatment duration			
< 5 years	11 (55)	10 (50)	0.422
≥ 5 years	9 (45)	10 (50)	
Treatment			
Monotherapy	4 (20)	4 (20)	0.794
Combination therapy	16 (80)	16 (80)	
HbA _{1c}	8.29 ± 0.68	8.16 ± 0.87	0.616

Table 3 summarizes adherence of T2DM patients between the two groups. The results showed that there was a significant increase in adherence in the intervention group $p < 0.05$ (11.33 ± 8.47) while in the control group there was no significant increase $p > 0.05$ (2.18 ± 15.56).

The decrease or HbA_{1c} control is the therapy goal of T2DM treatment. The decrease in HbA_{1c} is affected by various factors including precision in the selection of antidiabetic drugs according to patient condition, lifestyle modification, and patient adherence factor in treatment. Table 4 summarizes the mean decrease in HbA_{1c} in the intervention group (1.32 ± 0.72) and control group (0.13 ± 1.10). The decrease in HbA_{1c} in the intervention group was greater than in the control group.

Pearson correlation test was performed to find out the relationship of adherence with the HbA_{1c} level of T2DM patients; the correlation test result is presented in Table 5. The results showed that there was a significant relationship between adherence with HbA_{1c} levels.

DISCUSSION

Characteristic and medical data (HbA_{1c}) of T2DM patients were statistically analyzed using an independent sample t-test to see differences in baseline data between control and intervention groups. Based on the results of the analysis indicated that all characteristic data and HbA_{1c}. HbA_{1c} measured at the beginning before treatment between the intervention group and the control group did not differ significantly statistically $p > 0.05$. These results are excellent for proving that the results of the study are not biased, meaning that the initial values between the intervention and control groups are not different then if there is improvement this is due to the effect of intervention not because the value between the intervention group and the control group has been significantly different since the beginning.

The association between participants, health-care providers, and social support was a fundamental interpersonal factor associated with medication adherence [12]. In this study, counseling patient on T2DM at the first visit and given a reminder and motivation SMS 15 times until the second visit. The intervention provided allows for the establishment of professional relationships between pharmacists - patients who are

Table 3: Adherence of T2DM patients (mean \pm SD)

Group	Mean \pm SD	Δ	P
Pre-control	79.46 \pm 972	2.18 \pm 15.56	0.538
Post control	81.65 \pm 11.45		
Pre-intervention	81.50 \pm 8.34	11.33 \pm 8.47	0.000*
Post-intervention	92.83 \pm 6.23		

* $p < 0.05$, Δ : Increase adherence, p value of paired sample t-test, SD: Standard deviation, T2DM: Type 2 diabetes mellitus

Table 4: HbA_{1c} of T2DM patients (mean \pm SD)

Group	Mean \pm SD	Δ	p-value
Pre-control	8.16 \pm 0.87	0.13 \pm 1.10	0.604
Post control	8.03 \pm 0.89		
Pre-intervention	8.29 \pm 0.68	1.32 \pm 0.72	0.000*
Post-intervention	6.97 \pm 0.67		

* $p < 0.05$, Δ : Decrease in HbA_{1c}, p value of paired sample t-test, SD: Standard deviation, T2DM: Type 2 diabetes mellitus

Table 5: Test the correlation between adherence and HbA_{1c}

Group	Correlation coefficient	p-value
Adherence HbA _{1c}	0.254	0.023*

* $p < 0.05$, p value of Pearson correlation

better able to improve patient trust to contribute the better medication adherence. Good communication between health-care providers and patients leads to better medication adherence in patients with T2DM [13]. Based on the results of the study in Table 3 show that after counseling and SMS reminders and motivations have been achieved a significant adherence improvement in the intervention group compared to the control group ($p < 0.05$). This is in line with Chung *et al's* study that the intervention provided by pharmacists exhibit a positive effect on improving adherence of patients with T2DM [14].

Comprehensive education by pharmacists on the management of diabetes may encourage patient adherence to the prescribed regimen [15]. Adherence plays an important role in achieving therapy targets, especially chronic diseases such as DM. The low adherence of patients to the treatment of DM is one of the causes of low blood sugar control [4]. The outcome of treatment will not be optimal without patients own awareness of medication adherence [16]. Measurement of outpatient adherence in the treatment of DM is important to know the effectiveness of treatment so that the target DM therapy can be achieved successfully. One way to assess T2DM patients' adherence is to perform a pill count calculation. Assessment of drug use with pill count method is the most common and practical method to use. The pill count method is also most efficient in terms of cost-effectiveness [17].

Measurements of HbA_{1c} before and after treatment were the parameters of successful treatment of T2DM patients as measured in this study. Based on the results of the study in Table 4, it is shown that there were no significant differences in the control group between data of pre-study and post-study $p > 0.05$. Different in the intervention group showed a significant difference between pre-study and post-study data $p < 0.05$. From these results, it can be concluded that the intervention in the form of counseling, SMS reminder, and motivation on T2DM therapy has a positive impact on the improvement of HbA_{1c} levels.

Pearson correlation test was performed to analyze drug adherence correlation with the HbA_{1c} level of the T2DM patient. The results showed that there was a positive correlation between patient's medication adherence and HbA_{1c} ($r = 0.254$, $p = 0.023$). The results of this study are in line with research conducted by Krapek *et al.* which states that the higher the level of obedience the more controlled HbA_{1c} of patients DMT2 [18]. Poor glycemic controls reflect non-adherence to antidiabetic medications [19].

CONCLUSION

Counseling and SMS motivational reminders provided by pharmacists had a positive effect on improving medication adherence and controlling HbA_{1c} levels. The higher the level of adherence the more controlled HbA_{1c} patients T2DM.

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AUTHORS CONTRIBUTION

Wirawan Adikusuma conceived and designed the experiments and provided the final approval to publish the manuscripts; Nurul Qiyaam analyzed and interpreted data.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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