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Original Research

The effect of pillbox use in increasing patients' adherence to type 2 diabetes mellitus therapy in Lubuk Kilangan health center

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Abstract

Adherence is the extent to which the patient takes the medication as determined by the health care provider. The success of a patient's therapy is strongly influenced by adherence to the use of the drug. Low adherence to therapy is a particular problem in patients with diabetes mellitus. Diabetes mellitus is a chronic metabolic disease characterized by elevated blood glucose levels, which cause damage to the heart over time, vasculature, eyes, kidneys, and nerves. The pill count method was used by calculating the rest of the drug from the patient to assess the patient's level of adherence. **Objective:** Adherence assessments are carried out through the Home Medication Review program. This study aimed to determine the differences in therapy adherence of patients with type 2 diabetes mellitus using the pill count method. **Method:** This type of research is experimental with pretest-posttest control group design research. This method is selected because the calculation of the rest of the drug is carried out before and after the intervention is given. Sampling in this study uses the total sampling method. The data was taken from Chronic Disease Management Program patients with type 2 diabetes mellitus treated at the Lubuk Kilangan Padang Health Center for January-March 2022. There are two groups of patients: patients with and without pillboxes. The data analysis used in this study is the Mann-Whitney Test. **Result:** The results showed a difference in the level of therapeutic adherence between the pillbox group and those who did not use the pillbox, with a value of p = 0.000 (p<0.05). **Conclusion:** It can be concluded that the level of adherence is higher in patients who use pillboxes than in those who do not.

Keywords: medication; adherence; patients; type 2 diabetes mellitus

INTRODUCTION

Adherence to treatment is the extent to which a patient takes medication as prescribed by a health care provider. Patient adherence is usually reported as the percentage of prescribed drug doses taken by the patient over a specified period.[1] Non-adherence to prescribed medical therapy has a negative impact on the potential for improving patient health and poor quality of life.[2] In addition, this non-compliance can result in drug therapy problems (DTP) that need special attention. For example, one chronic disease with high non-compliance is diabetes mellitus.[3,4]

According to the International Diabetes Federation, in 2019, Indonesia was in seventh place in the world with diabetes mellitus sufferers, namely 10.7 million people, and it is predicted that in 2030 there will be 13.7 million people. Whereas in 2045, Indonesia is predicted to be in eighth place, with the number of people with diabetes mellitus as many as 16.6 million.[5] According to the 2018 Basic Health Research (Riskesdas) report, the number of people with diabetes mellitus in the age group > 15 years is 2%. On the contrary, the highest diabetes mellitus occurs in the age group of 55-64, at 15.6%.[6,7] According to the 2018 West Sumatra basic health research, The prevalence of diabetes mellitus in West Sumatra was 1.64%, and the prevalence in Padang was 2.47%.[8]

One of the methods used in measuring adherence is the pill count. This method is carried out by calculating the remaining drug from the patient so that the percentage of adherence from the patient is obtained. This method is carried out by calculating the remaining drug that the patient gets during treatment in a certain period, with the percentage of adherence expressed by ≥ 80% and non-adherence <80%.[9] The pill count method measures patient adherence by calculating the patient's remaining medication to obtain % adherence using the Grymonpre formula.[4,10]

This study measured patient level of adherence by visiting patients at their homes, called the Home Medication Review program. HMR is one of the drug management programs funded by community pharmacy agreements to improve the quality of drug use services. The policy goal of the HMR program is to improve the quality of drug use and reduce medication errors by assisting patients in better managing and understanding the medicines they receive through drug reviews conducted by accredited pharmacists in the patient's home.[11] The Australian government initiated the Home Medication Review (HMR) program in 2001. The HMR program is designed

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to help patients living at home maximize the benefits of their medication regimen and prevent harm from drug abuse.[12]

The success of a patient's therapy is strongly influenced by adherence to drug use, one of which is type 2 diabetes mellitus patients. Unfortunately, low patient compliance has been reported in various studies.[14,13]

One way to support patient compliance is to provide pillboxes as a place to store drugs. Pillboxes can be an effective strategy to improve medication adherence. Improvements in device prescription, training, research, and design are needed to understand the mechanisms and size of the effects of this intervention.[14]

The Lubuk Kilangan Health Center is located in Lubuk Kilangan District, Padang City, which has a fairly high number of diabetes mellitus patients, namely 457 patients reported in the 2020 health profile of Padang City.[15] However, at the Lubuk Kilangan Health Center, there has never been an assessment of the level of adherence to patient therapy, so this study aims to increase adherence to treatment on type 2 diabetes mellitus in the Lubuk Kilangan Health Center, Padang City working area.

METHODS

Research design, population, and sample

The research was conducted from January to March 2022 in the Lubuk Kilangan Health Center, Padang City. The sample in this study was adult patients with type 2 diabetes mellitus at the Lubuk Kilangan health center, Padang City, in 2021. The data was taken from the health center's medical record using the total sampling method. This study's minimum number of samples is 15 subjects per group.[16,17] Determination of the treatment group (using pillboxes) and the control group (without pillboxes) was performed using Microsoft Excel (fx=RANDBETWEEN (group1; group2)) so that objectively divided data was obtained.[18]

Inclusion and exclusion criteria

In this study, adult patients with type 2 diabetes mellitus with or without other co-morbidities were the chronic disease management program (prolanis) participants. They were willing to participate in this study by filling out informed consent.

Data collection sheet

The data collection form is a formula containing data on the sociodemographic characteristics of the respondents (name, gender, age, education, occupation, social history, and habits), clinical factors of the respondents (diabetes mellitus history, co-morbidities, diabetes mellitus therapy, and family history of disease).

Formula calculation

The pill count method measures patient compliance by calculating the patient's remaining medication to obtain % adherence using the Grymonpre formula.[10] This method is carried out by calculating the remaining drug that the patient gets during treatment in a certain period, with the percentage of adherence expressed by ≥ 80% and non-adherence <80%.[18,19]

The pill count method can be calculated using the Grymonpre formula:

%Adherence=(A-B)/CXD X100

as well as calculations based on refill frequency derived from a provincial prescription claims database (manual and electronic:

A: The number of drugs given at the beginning

B: Amount of final remaining drug

C: Number of drugs taken per day

D: The interval between the pre and post-date of the interview

Data analyze

The chi-Square test is used to see the difference in the proportion of each characteristic variable between the treatment and control groups. The normality test is used to see if the data is normally distributed or not using the Shapiro-Wilk test. In this study, a non-parametric test was carried out using the Mann-Whitney test to compare differences in adherence levels between the treatment and control groups. The test was carried out with a significant level ($p < 0.05$).

RESULTS

The sample used in this study was Type 2 prolanis Diabetes Mellitus patients at the Lubuk Kilangan Health Center, Padang City. The number of samples used was 52, which were then grouped into two groups, namely the control group (not using the pillbox) and the treatment group (using the pillbox), each of which had 26 samples.

Sociodemographic data of type 2 Diabetes Mellitus patients in this study can be seen in Table 1. Sociodemographic data of patients consist of age, gender, education, and occupation. Based on the age and frequency of type 2 diabetes mellitus patients at the Lubuk Kilangan Health Center with adults, eight patients used pillboxes, and 18 did not. Whereas in the

Table 1. Sociodemographic characteristics of T2DM with and without pillbox

Characteristic	Category	Pillbox (N=26)		Without Pillbox (N=26)		p-value
		(n)	(%)	(n)	(%)	
Age	Adult	8	30.77%	18	69.23%	0.006[a]
	Geriatric	18	69.23%	8	30.77%	
Gender	Male	6	23.08%	5	19.23%	0.734[a]
	Female	20	76.92%	21	80.77%	
Education	Low	16	61.54%	17	65.38%	0.693[b]
	Middle	7	26.92%	8	30.77%	
	High	3	11.54%	1	3.85%	
Occupation	Working	1	3.85%	4	15.38%	0.350[b]
	Not working	25	96.15%	22	84.62%	

a: Chi-Square Test, significant p<0,05
b: Fisher's Exact Test, significant p<0,05

elderly, 18 patients used pillboxes, and eight patients did not use pillboxes. The Chi-Square test shows a difference in the proportion between those who use pillboxes and those who do not, with a p-value <0.05. The grouping of data in this study was carried out randomly. Before grouping the sociodemographic data, it was unknown. It could not be controlled, so in the age category, there were differences in the proportions between groups using pillboxes and those who did not.

Treatment data for type 2 diabetes mellitus patients at the Lubuk Kilangan Health Center can be seen in the Table 2. More patients received combination therapy than single therapy. The number of patients who received combination therapy was 18, or 69.23%, who used pillboxes and 17 patients or 65.38% who did not. In comparison, eight patients received single therapy, or 30.77%, used pillboxes, and nine patients, or 34.62%, did not use pillboxes.

Table 2. Medication therapy of T2DM received by the respondent

Type	Medication	Pillbox (N=26)		Without-Pillbox (N=26)	
		(n)	(%)	(n)	(%)
Single	Metformin HCl 500 mg	8	30.77%	7	26.92%
	Glimepiride 2 mg	0	0%	2	7.69%
Combination	Metformin HCl 500 mg + Glimepiride 1 mg	0	0%	3	11.54%
	Metformin HCl 500 mg + Glimepiride 2 mg	14	53.85%	13	50%
	Metformin HCl 500 mg + Glimepiride 3 mg	3	11.54%	0	0%
	Metformin HCl 850 mg + Glimepiride 3 mg	0	0%	1	3.85%
	Acarbose 100 mg + Glimepiride 1 mg	1	3.85%	0	0%

The level of adherence of patients with type 2 diabetes mellitus at the Lubuk Kilangan Health Center can be seen in Table 3. In this study, adherence was calculated using the pill count method. Patients can be said to adhere if the percentage of compliance is ≥80% and said to be disobedient if the percentage of adherence is <80%.

The initial and final adherence values of type 2 diabetes mellitus patients can be seen in Table 4. Based on this table, it can be seen that the average initial adherence of type 2 diabetes mellitus patients was 86.876% who used pillboxes and 89.380% who did not use pillboxes. From the Mann-Whitney Test conducted, it was found that the value of p = 0.246 (p> 0.05) means that there was no significant difference in initial adherence between the pillbox group and the group that did not use the pillbox. In the final compliance, the average pillbox adherence was 93.380%. For those who do not use pillboxes, it is 86.784%. From the results of the Mann-Whitney Test, the value of p=0.077 (p>0.05) was obtained, meaning there was no significant difference between the group using pillboxes and those not using pillboxes. But judging from the average final adherence value using a pillbox is higher than the average final adherence not using a pillbox.

Table 3. Adherence level of T2DM patients

Groups	Adherence level	Pre-		Post-	
		(n)	(%)	(n)	(%)
Pillbox	Adhere (≥80%)	21	80.77%	25	96.15%
	Non-Adhere (<80%)	5	19.23%	1	3.85%
Without Pillbox	Adhere (≥80%)	20	76.92%	20	76.92%
	Non-Adhere (<80%)	6	23.08%	6	23.08%

Table 4. Adherence Value of Patients with Type 2 Diabetes Mellitus Early and Late

Adherence	Group	$\bar{X}$ (%)	SE	SD	p-value
Pre-	Pillbox	86.876	2.520	12.851	0.246
	Without Pillbox	89.380	2.524	12.868	
Post	Pillbox	93.380	1.451	7.399	0.077
	Without Pillbox	86.784	3.442	17.549	

Mann-Whitney Test, significant p<0,05

DISCUSSION

The descriptive analysis of gender in this study that the most type 2 diabetes mellitus patients were women, 56.5%. Women are more likely to suffer from diabetes mellitus due to hormonal factors and tend to experience weight gain.[20] Several research also revealed that most people with type 2 diabetes mellitus are women.[21,22] More women suffering from diabetes mellitus can be influenced by lifestyle, lack of physical activity, stress factors, and women experiencing pre-menopausal and menopausal periods.[22] Based on the Chi-Square test, there is no significant difference between the proportions between pillboxes and without pillboxes with p>0.05.

The frequency of patients with type 2 diabetes mellitus at the Lubuk Kilangan Health Center, based on their level of education, suffers more from those with low levels of education. At the educational level, the Fisher's Exact Test was carried out because the data from the Chi-Square test did not meet the requirements. The Fisher's Exact Test shows p>0.05, meaning there is no difference in the proportion between pillboxes and no pillboxes. The descriptive analysis of education level in this study is in line with previous research which found that people with low education suffer more from diabetes mellitus as 83.8%.[16] Education is important in understanding management, blood sugar control, addressing symptoms that arise, and preventing complications. Patients with higher education have better knowledge about diabetes and its effects on health, so they can respond to the disease positively and will try to handle it. [16]

From the research results at the Lubuk Kilangan Health Center, the number of patients with type 2 diabetes mellitus based on work was dominated by patients who did not work, including homemakers and retirees. The descriptive analysis of the type of work in this study is in line with research conducted by Muliyani

(2019) that the number of type 2 diabetes mellitus patients at RSUD Dr. H. Moch. Ansari is dominated by patients who do not work, consisting of homemakers, with a total of 23 people or 82.1%.[23] The type of work can affect physical activity and stress. High stress can increase the hormone epinephrine, an insulin antagonist hormone that inhibits insulin action, causing the mobilization of glucose, fatty acids, and lactic acid, which can affect blood sugar levels.[24] In this study, most respondents were housewives, so they did not work. Homemakers can experience stress because they don't have the option to carry out work activities in the office, can't build a career, can't play a role in making money, and experience boredom with routines that can be said to rely more on energy.[23] Homemakers are women with more mobility problems than men, normal activities, and pain or discomfort. [25]

Treatment received by patients varies according to each patient's clinical condition, both single therapy and combination therapy. Patient therapy distribution data can be seen in Table 4 and 5. In a single treatment, more drugs were given, namely Metformin HCl 500 mg, with eight patients, or 30.77%, who used pillboxes and seven patients, or 26.92%, who did not. Indonesian Endocrinology Association (2019) states that metformin is the first-line treatment in most cases of type 2 diabetes mellitus because it has relatively good effectiveness, low side effects of hypoglycemia, neutral to weight gain, can improve cardiovascular outcomes, and has a low price. Relatively inexpensive. [26]

The combination therapy that was widely used in this study was the combination of Metformin HCl 500 mg with Glimepiride 2 mg with a total of 14 patients, or 53.85% who used pillboxes and 13 patients, or 50% who did not use pillboxes. The combination of Metformin with Glimepiride provides a better effect because it can reduce cardiovascular risk, significantly reducing fasting blood glucose levels, post-prandial blood glucose levels, HbA1c levels, and Hcy (Homocysteine) levels. This combination can also reduce total cholesterol and triglyceride levels, reduce the Lower Density of Lipoprotein, and increase Higher Density Lipoprotein**.** [27]

Compliance assessment was carried out twice, namely at the beginning of the visit by calculating the patient's drug remaining 30 days before and at the end by calculating the patient's remaining 30 days later. At the initial assessment, patients in the adherent category were 21, or 80.77%, who used pillboxes, and 20 patients, or 76.92%, who did not. At the same time, five patients who did not comply with the initial assessment or 19.23%, used pillboxes, and six patients, or 23.08%, did not. In the final evaluation, 25 adherent patients or 96.15%, used pillboxes, and 20 patients, or 76.92%, did not use pillboxes. Patients who did not comply with the final assessment were one patient, or 3.85%, who used pillboxes, and six patients, or 23.08%, who did not use pillboxes.

From the analysis of the initial and final adherence levels in the treatment and control groups, it can be seen that the increase in patient adherence to therapy using pillboxes was higher, increasing from 80.77% to 96.15%. At the same time, patients who did not use pillboxes did not improve adherence. Therapeutic adherence in the treatment group can increase due to the influence of giving pillboxes or pill reminder containers that can help patients take medication because they have been arranged in single-use doses and daily doses.[4]

CONCLUSION

The level of adherence to therapy for type 2 diabetes mellitus patients in the treatment group (using pillboxes) was higher than the control group (without pillboxes) with a value of p = 0.000 (p <0.05), which means that there was a difference in the level of adherence between the treatment group and the control group. Further research is needed to assess patient adherence through a Home Medication Review with a larger population and health workers at the health care facilities and provide education and counseling to patients to achieve the goals of medication therapy.

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COMPETING INTERESTS

The author(s) declare no conflict of interest regarding this manuscript.

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AUTHOR CONTRIBUTION

NF and YOS designed the study, KH and FTA carried out the fieldwork, and next, NF and KH analyzed the data. NF wrote the manuscript, and All authors read and approved the final version of the manuscript.

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