

Public Counseling: An Educational Model to Improve Medication Adherence in Type 2 Diabetes Mellitus Patients

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Abstract: Introduction: Diabetes mellitus is a major chronic illness worldwide, including in Indonesia. Also, the adherence to antidiabetic medicines remains unsatisfactory. Aim: This study aimed to evaluate the effectiveness of public counseling to increase medication adherence in patients with type 2 diabetes mellitus. Methods: This prospective study used a pre-test-post-test quasi-experimental design. It was conducted at Pondok Kelapa primary health care center in East Jakarta. The intervention was public counseling that was delivered once per month for three months (12 weeks) of the study period. The A1C (glycated haemoglobin) was assessed twice, i.e., before and after the intervention. Results: Among the 30 patients who met the inclusion criteria, 83.3% of them had the A1C level >6.5%. After 12 weeks of intervention, the percentage of A1C significantly declined to 23.3% ($p=0.00$). Conclusion: Public counseling is effective to increase medication adherence in patients with type 2 diabetes mellitus.

1 INTRODUCTION

Diabetes mellitus (DM) is defined as elevated blood glucose attributable to inadequate or no pancreatic insulin secretion, with or without the concurrent impairment of insulin action (Katzung and Trevor, 2015). In most cases, type 2 DM is characterized by a combination of some degree of insulin resistance and relative insulin deficiency (DiPiro *et al.*, 2015).

Using a DM-based interview, the national survey in 2013 showed that the prevalence of DM increase from 1.1% (2007) to 2.1% (2013). The highest prevalences were found in Yogyakarta (2.6%), Jakarta (2.5%), North Sulawesi (2.4%), and East Kalimantan (2.3%) (Badan Penelitian dan Pengembangan Kesehatan, 2013). According to WHO (World Health Organization, 2016), the prevalence of DM in Indonesia in 2016 was 7.0%.

DM is a chronic illness that requires continuous medical care and patient education and support in self-management to prevent acute complications and reduce the risk of long-term complications. Diabetes care is complex, and it requires multifactorial risk reduction strategies beyond glycemic control (Care, 2013).

The American Diabetes Association (ADA, 2017) mentions that 33-49% of patients still persistently fail to meet the targeted A1C level. One of the major contributing factors is poor medication adherence (Polonsky and Henry, 2016). Patients with DM usually have comorbidities that make their treatment regimens even more complex and probably lower the adherence. Poor adherence to DM treatment results in the avoidable development of complications of diabetes and the extra costs for the healthcare system (De Geest and Sabaté, 2003).

Education is one of the various measures to increase adherence in type 2 DM patients (García-Pérez *et al.*, 2013). Patient education constitutes a critical tool used to control diabetes better and help with the prevention of complications and cost reduction. There is no adequate evidence of which education methods are the most effective in improving the clinical outcomes of people with type 2 DM (Merakou *et al.*, 2015). Pharmacists can contribute and play a major role in the assessment of patients' understanding of the illness and therapy of DM, including the discussion of any barriers to adherence that patients may have (Inamdar *et al.*, 2013).

Group education has been characterized as a

cost-effective alternative to individual education for DM. Taking place in a primary health care center in Greece, Merakou *et al.* (2015) confirm that group-based patient education with some models for people with type 2 DM is more effective in diabetes self-management compared with individual education. This finding is positively encouraging since group education needs a small amount of resource but improves patient outcome, especially when faced with the limited number of pharmacists in primary health care centers in Indonesia. Many models apply to group discussions. One of them is public counseling. Hence, this research aimed to assess the effectiveness of public counseling model at a primary health care center in East Jakarta.

2 MATERIALS AND METHOD

2.1 Materials

The tool used to collect the research data was the A1C level reader, i-Chroma TM.

2.2 Methods

This prospective study used a total sampling method and took place at Pondok Kelapa primary health care center in East Jakarta, Indonesia from July 2017 to October 2017. The participants were patients with type 2 DM. The pre-test-post-test quasi-experimental design was intended to measure the effectiveness of public counseling that was delivered during the study period. The intervention was given three times in 12 weeks. The collected data was A1C (the glycated haemoglobin) levels from the pre-test and post-test.

The inclusion criteria:

- Patients aged >18 years;
- Patients had DM for more than one year;
- Patients took oral antidiabetic drugs (OADs);
- Patients with fasting blood sugar level >126 mg/dL in three (3) consecutive months;
- Patients who regularly came to the primary health care center for a routine check-up.

The exclusion criteria:

- Pregnant women

The research proposal was submitted to the Research Ethics Committee of Faculty of Medicine, University of Indonesia. This study had received the Ethical Approval test and passed the study ethics

(No. 325/UN2.FI/ETIK/2017). Patient screening was conducted after the research permit was granted. Patients were asked for their willingness to participate as research respondents by signing a letter of approval of participation or informed consent and given information in advance. The stages of data collection:

- Subjects who had declared their willingness to become respondents filled out the consent form to participate in the research. The minimum sample size was not specified. The data collection used total sampling method, i.e., the samples are all respondents who are willing to follow the course of the entire study and within the inclusion criteria;
- The initial measurement of HbA1C levels as the pre-test data;
- Respondents were given education in the form of public counseling three times in three (3) months;
- The public counseling was delivered to the patients by two researchers, i.e., the lecturers at the Faculty of Pharmacy and Sciences, UHAMKA. The one-hour lecture was then followed by another hour of Q&A session. This provision of education was conducted in one of the rooms in the primary health care center. The presented material was divided into three parts: (1) General explanation of DM, complications of DM, and DM therapy (including the explanation of 'if the patient forgets to take medication') (2) Diabetic diet plan and repeated explanation of DM therapy, (3) Physical exercise plan and repeated explanation of DM therapy. Technically, patients were gathered in a room at the primary health care center and then provided with the education in the form of lectures. At the end of the lectures, a Q&A session (discussion) was conducted;
- The post-test data were obtained by re-measuring HbA1C levels after three months;
- The data was then subjected to processing and analysis.

2.3 Data Analysis

The data were analyzed descriptively to obtain a frequency distribution and the proportion of various research variables. The three variables were sociodemographic characteristics, clinical characteristics, and lifestyle characteristics. The Wilcoxon's t-test was performed to determine the changes in A1C level. Statistical significance was set at $p < 0.05$. All statistical analyses were performed in the Statistical Package for Social Sciences (SPSS) software for Windows version 22.0.

Table 1: The Sociodemographic characteristics of the Respondents.

Characteristics		n = 30	%
Sex	Male	11	36.7
	Female	19	63.3
Age	< 60 years	6	20.0
	≥ 60 years	24	80.0
Level of education	Low	8	26.7
	Middle	11	36.7
	High	11	36.7
Occupation	Unemployed	27	90.0
	Employed	3	10.0

3 RESULTS AND DISCUSSION

From July to October 2017, as many as 50 patients were selected as respondents, but only 30 of them participated until the end of the 12-week study.

3.1 Patient Characteristics

The distribution of respondents based on sociodemographic characteristics is shown in Table 1. The majority of the respondents were female (63.3%). The national data of the prevalence of type 2 DM verifies this finding, i.e., that the majority of type 2 DM patients are females (Badan Penelitian dan Pengembangan Kesehatan, 2013). Most of the respondents were aged ≥ 60 years (80.0%). According to a consensus report, population aging is a significant driver of the diabetes epidemic (Kirkman *et al.*, 2012). The respondents mostly had middle and high levels of education (36.7% each). According to a study at a primary health care center in Jakarta, there is no significant correlation between the level of education and type 2 DM incidence (Trisnawati and Setyorogo, 2013). Around 90% of the respondents were unemployed since most of them were retired.

The distribution of respondents based on clinical characteristics is presented in Table 2. Approximately 63.3% of them had a history of type 2 DM for ≥ 5 years. Gimenes *et al.*, (2009) and Elsous *et al.* (2017) claim that there is a negative relationship between the history of DM and patients' adherence to medications. In other words, the longer the history of DM, the more noncompliance a patient to his/her medication. The majority of the respondents received >1 oral antidiabetic drugs (OAD) (80.0%). A single or a combination of OAD can be used if necessary, and the combined OADs should act by different mechanisms

Table 2: The clinical characteristics of the respondents.

Characteristics		n = 30	%
History of type 2 DM	< 5 years	11	36.7
	≥ 5 years	19	63.3
Numbers of oral antidiabetic drug (OAD)	1	6	20.0
	> 1	24	80.0
Comorbidity	No	4	13.3
	1	18	60.0
	2 or more	8	26.7
Other medicines	Yes	26	86.7
	No	4	13.3
Adverse Drug Reaction	Yes	8	26.7
	No	22	73.3

(PERKENI, 2015). Most of the respondents had one comorbidity (60.0%). Hypertension was the most common comorbidity in this study. Hypertension substantially increases the risk of both macrovascular and microvascular complications, including stroke, coronary artery disease, and peripheral vascular disease, retinopathy, nephropathy, and possibly neuropathy (ADA, 2003). The majority of the respondents (86.7%) used other medicines. This condition was attributable to the comorbidity, which made their treatment regimens even more complex and probably reduced the adherence (De Geest and Sabaté, 2003). Only 26.7% of the respondents experienced an adverse drug reaction (side effect). Wabe *et al.*, (2011) explain that the main external factors for nonadherence are lack of finance (37.1%) and, followed by, a perceived side effect of the drug (29.2%).

The distribution of respondents based on lifestyle characteristics is summarized in Table 3. Around 83.3% of them adjusted their dietary habit to include sugar and carbohydrate restriction. Patients with type 2 DM often require caloric restriction to promote weight loss (DiPiro *et al.*, 2015). Patients should have good knowledge about their disease and recommended diet, and, for this purpose, the health care providers must inform them to make changes in their nutritional habits and food preparations. Active and effective dietary education may prevent the onset of diabetes and its complications (Sami *et al.*, 2017). The comparison of pre-test and post-test data showed a decrease in the number of respondents who were smoking. Several studies have also associated smoking with an increased risk of developing diabetes. Smoking increases diabetic incidences and aggravates glucose homeostasis and chronic diabetic complications (Chang, 2012).

Table 3: The lifestyle characteristics of the respondents.

Characteristics n = 30		Pre-test		Post-test	
		%	n = 30	%	
Dietary habit	Adjusted	25	83.3	24	80.0
	Not adjusted	5	16.7	6	20.0
Smoking	Yes	3	10.0	1	3.3
	No	27	90.0	29	96.7
Exercise	Yes	28	93.3	27	90.0
	No	2	6.7	3	10.0
Herbs	Yes	1	3.3	1	3.3
	No	29	9.7	29	96.7

The Indonesian Association of Endocrinologists (*Perkumpulan Dokter Endokrinologi Indonesia*) state that exercise is one of the most important things in DM management if not accompanied by nephropathy. Exercise should be practiced regularly, i.e., 3-5 times a week for about 30-45 minutes with 150 minutes in total per week. The pause between exercises is not more than two consecutive days (PERKENI, 2015). According to Puspitasari *et al.* (2013), the use of herbal medicines as hypoglycemic agents does not give a significant effect on the A1C level because the information regarding the dose, duration, and administration of the herbal medicines may be uncertain.

3.2 The Effectiveness of Education (Public Counseling)

The parameter used to assess compliances was A1C level. A1C reflects the average glycemia over several months and has a strong predictive value for diabetes complications (Cameron, 2006). Some studies have reported that an increase in medication adherence to oral hypoglycemics is associated with a reduction in the A1C level, indicating a positive correlation between A1C level reduction and medication adherence (Lin *et al.*, 2017). The goal of the A1C level in DM management is $\leq 6.5\%$ (American Diabetes Association (ADA), 2017).

Table 4: The mean A1C levels before and after intervention.

A1C levels	Pre-test		Post-test	
	n = 30	%	n = 30	%
a. < 6.5%	5	16.7	23	76.7
b. ≥ 6.5%	25	83.3	7	23.3
Mean ± SD	7.83±1.59		5.41±1.34	
P	0.00			

The A1C level in this research was measured at the Indonesian Center for Health Laboratory, Ministry of Health, which has been accredited according to ISO/IEC 17025:2005. The analysis of the measurement results referred to the methods used in DCCT (The Diabetes Control and Complication Trial), i.e., HPLC method (High-Performance Liquid Chromatography) (Sacks *et al.*, 2011). The mean A1C levels in the pre-test and post-test are shown in Table 4.

Around 83.3% of the respondents still had a high A1C level ($\geq 6.5\%$) before the intervention. However, the number declined to 23.3% after they received the education. The results showed a significant difference ($p = 0.00$) between the A1C levels before and after the intervention. The mean A1C level before the intervention was $7.83 \pm 1.59\%$, which declined after the public counseling (5.41 ± 1.34). As a conclusion, education increases medication adherence in type 2 DM patients.

Wulandari *et al.* (2017) conducted similar research at Makassar and Kebon Pala primary health care centers in East Jakarta in 2017. Using public counseling and booklet handouts as a model of education, they reveal that among the type 2 DM respondents who completed the interventions, 63.3% of them initially had HbA1C level $> 7\%$. However, after the interventions, the percentage declined significantly ($p < 0.05$) to 23.3%.

Table 5: The mean A1C levels before and after intervention at Makassar and Kebon Pala primary health care centres.

A1C levels	Pre-test		Post-test	
	n = 30	%	n = 30	%
a. < 7%	11	36.7	23	76.7
b. ≥ 7%	19	63.3	7	23.3
Mean ± SD	7.72±1.356		6.18±0.988	
P	0.00			

as seen in Table 5. As a conclusion, intervention with public counseling and booklet handouts is effective to improve the compliance of patients with type 2 DM.

Both Wulandari *et al.* (2017) and this study used respondents from primary health care centers in East Jakarta, but they differed in the model of education. Public counseling alone also significantly improves patient's adherence to complete the medication. Taking place in a primary health care center in Greece, Merakou *et al.* (2015) state that group-based patient education with some models for people with type 2 DM is more effective in diabetes self-management compared with individual education.

Medication adherence is the most important component in type 2 DM management. It is achievable by giving routine education to patients to increase their knowledge about their disease and medication. Pharmacists can contribute and play a major role in the assessment of patients' understanding of the illness and therapy of DM (Inamdar *et al.*, 2013). Hughes *et al.* (2017) explain that there is significant evidence to support the role of pharmacists in providing a range of extensive diabetes care services, from the screening to the continuous management of the state of the disease. Furthermore, Supardi and Susyanti (2012) state that only 10% of the primary health care centers in Indonesia have pharmacists. The limited number of pharmacists at primary health care centers inhibits the provision of personal education by pharmacists to the patients. Public counseling becomes an alternative that is effective and cost-efficient.

4 CONCLUSIONS

Educational intervention through public counseling is significantly effective to improve medication adherence in type 2 diabetes mellitus patient.

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REFERENCES

American Diabetes Association (ADA), 2003. Treatment of hypertension in adults with diabetes, *Diabetes*

- Care*, 26(suppl 1), pp. S80–S82. doi: 10.2337/DIACARE.26.2007.S80.
- American Diabetes Association (ADA), 2017. Standard of medical care in diabetes - 2017, *Diabetes Care*, 40 (suppl 1)(January), pp. s4–s128. doi: 10.2337/dc17-S003.
- Badan Penelitian dan Pengembangan Kesehatan, 2013. *Riset Kesehatan Dasar (RISKESDAS) 2013*, Laporan Nasional 2013, pp. 1–384. doi: 1 Desember 2013.
- Cameron, F., 2006. Standards of Medical Care in Diabetes - 2016, *Australian family physician*, 35(6), pp. 386–390. doi: 10.2337/dc14-S014.
- Care, M., 2013. Standards of medical care in diabetes - 2013, *Diabetes Care*, 36(SUPPL.1). doi: 10.2337/dc13-S011.
- Chang, S. A., 2012. Smoking and type 2 diabetes mellitus, *Diabetes and Metabolism Journal*, 36(6), pp. 399–403. doi: 10.4093/dmj.2012.36.6.399.
- De Geest, S. and Sabaté, E., 2003. Adherence to long-term therapies: Evidence for action, *European Journal of Cardiovascular Nursing*, 2(4), p. 323. doi: 10.1016/S1474-5151(03)00091-4.
- DiPiro, J. T., Wells, B. G., Schwinghammer, T. L., DiPiro, C. V., 2015. *Pharmacotherapy handbook*. Available at: <http://www.loc.gov/catdir/toc/mh023/99073195.html%5Cnhttp://www.loc.gov/catdir/enhancements/fy0653/99073195-d.html>.
- Elsous, A., Radwan, M., Al-Sharif, H., Mustafa, A. A., 2017. Medications adherence and associated factors among patients with type 2 diabetes mellitus in the Gaza Strip, Palestine, *Frontiers in Endocrinology*, 8(JUN), pp. 1–9. doi: 10.3389/fendo.2017.00100.
- García-Pérez, L.-E., Alvarez, M., Dilla, T., Gil-Guilen, V., Orozco-Beltran, D., 2013. Adherence to Therapies in Patients with Type 2 Diabetes, *Diabetes Therapy*, 4(2), pp. 175–194. doi: 10.1007/s13300-013-0034-y.
- Gimenes, H., Zanetti, M. and Vanderlei, J., 2009. Factors related to patient adherence to antidiabetic drug therapy, *Revista latinoam Enfermagem*, 17(1), pp. 46–51. doi: 10.1590/S0104-11692009000100008.
- Hughes, J. D., Wibowo, Y., Sunderland, B., Hoti, K., 2017. The role of the pharmacist in the management of type 2 diabetes: current insights and future directions, *Integrated Pharmacy Research and Practice*, 6, pp. 15–27. doi: 10.2147/IPRP.S103783.
- Inamdar, S. Z., Kulkarni, R. V., Karajgi, S. R., Manvi, F. V., Ganachari, M. S., Mahendra-Kumar. B. J., 2013. Medication Adherence in Diabetes Mellitus: An Overview on Pharmacist Role, *American journal of advanced drug delivery*, 1(3), pp. 238–250.
- Katzung, B. G. and Trevor, A., 2015. *Basic & Clinical Pharmacology*, 13th Edition, Basic and Clinical Pharmacology.
- Kirkman, M. S., Briscoe, V. J., Clark, N., Florez, H., Haas, L. B., Halter, J. B., Huang, E. S., Korytkowski, M. T., Munshi, M. N., Odegard, P. S., Pratley, R. E., Swift, C. S., 2012. Diabetes in older adults, *Diabetes Care*, 35(12), pp. 2650–2664. doi: 10.2337/dc12-1801.
- Lin, L.-K. Sun, Y., Heng, B. H., Chew, D. E. K., Chong, P. N., 2017. Medication adherence and glycemic control among newly diagnosed diabetes patients, *BMJ Open*

- Diabetes Research & Care*, 5(1), p. e000429. doi: 10.1136/bmjdr-2017-000429.
- Merakou, K. Knithaki, A., Karageorgos, G., Theodoridis, D. Barbouni, A., 2015. Group patient education: Effectiveness of a brief intervention in people with type 2 diabetes mellitus in primary health care in Greece: A clinically controlled trial, *Health Education Research*, 30(2), pp. 223–232. doi: 10.1093/her/cyv001.
- PERKENI, 2015. *Konsensus Pengendalian dan Pencegahan Diabetes Melitus Tipe 2 di Indonesia 2015*, Perkeni. doi: 10.1017/CBO9781107415324.004.
- Polonsky, W. H. and Henry, R. R., 2016. Poor medication adherence in type 2 diabetes: Recognizing the scope of the problem and its key contributors, *Patient Preference and Adherence*, 10, pp. 1299–1306. doi: 10.2147/PPA.S106821.
- Puspitasari, A. W., R.Andrajati and A.Bahtiar, 2013. Analisis Efektivitas Booklet Obat terhadap Tingkat Kepatuhan Pasien Diabetes Melitus tipe-2, *Journal of Management and Pharmacy Practice*, 2, pp. 1–7.
- Sacks, D. B. Arnold, M., Bakris, G. L., Bruns, D. E., Horvath, A. R., Kirkman, M. S., Lernmark, A., Metzger, B. E., Nathan, D. M., 2011. Guidelines and recommendations for laboratory analysis in the diagnosis and management of diabetes mellitus, *Diabetes Care*, 34(6). doi: 10.2337/dc11-9998.
- Sami, W. Ansari, T., Butt, N. S., Hamid, M. R. A., 2017. Effect of diet on type 2 diabetes mellitus: A review, *International journal of health sciences*, 11(2), pp. 65–71. doi: 10.1002/dmrr.2515.
- Supardi, S. and Susyanti, A. L., 2012. Kebijakan penempatan apoteker di puskesmas, *Buletin Penelitian Sistem Kesehatan*, (15), pp. 133–142. Available at: <http://ejournal.litbang.depkes.go.id/index.php/hsr/article/view/2987/2220>.
- Trisnawati, S. K. and Setyorogo, S., 2013. Faktor Risiko Kejadian Diabetes Melitus Tipe II Di Puskesmas Kecamatan Cengkareng Jakarta Barat Tahun 2012, *Jurnal Ilmiah Kesehatan*, 5(1), pp. 6–11.
- Wabe, N. T., Angamo, M. T., & Hussein, S., 2011. Medication adherence in diabetes mellitus and self-management practices among type-2 diabetics in Ethiopia, *North American Journal of Medical Sciences*, 3(9), 418–.
- World Health Organization, 2016. *Diabetes Country Profile*, diabetes country profile Indonesia, 48(6), p. 18882A–18882B. doi: 10.1111/j.1467-825X.2011.03931.x.
- Wulandari, N., Viviandhari, D. and Nurhayati, 2017. A Strategic Approach to Increase the Compliance of Patients with Type 2 Diabetes Mellitus, in Unity in Diversity and the Standardisation of Clinical Pharmacy Services: *Proceedings of the 17th Asian Conference on Clinical Pharmacy (ACCP 2017)*, in Elida, Z. et al. (eds). Yogyakarta: CRC Press/Balkema. doi: ISBN: 978-1-138-08172-7 (Hbk) ISBN: 978-1-315-11275-6 (eBook).