A randomized controlled trial of a pharmacist-led intervention to enhance knowledge of Vietnamese patients with type 2 diabetes mellitus

Nguyen, Thao H; Tran, Tam T T; Nguyen, Nguyet K; Diep, Han G; Vo, Son D; Taxis, Katja; Pham, Suol T; Nguyen, Thang

Published in:
The International Journal of Pharmacy Practice

DOI:
10.1093/ijpp/riac030

International Journal of Pharmacy Practice, 2022, **30**, 449–456
https://doi.org/10.1093/ijpp/riac030
Advance access publication 26 April 2022
Research Paper

IJPP International Journal of Pharmacy Practice

OXFORD

A randomized controlled trial of a pharmacist-led intervention to enhance knowledge of Vietnamese patients with type 2 diabetes mellitus

Thao H. Nguyen[1,‡], Tam T. T. Tran[2,‡], Nguyet K. Nguyen[3], Han G. Diep[3], Son D. Vo[2], Katja Taxis[4], Suol T. Pham[3] and Thang Nguyen[3,*]

[1]Department of Clinical Pharmacy, University of Medicine and Pharmacy at Ho Chi Minh City, Ho Chi Minh City, Vietnam
[2]Faculty of Pharmacy, Hau Giang General Hospital, Hau Giang Province, Vietnam
[3]Department of Pharmacology and Clinical Pharmacy, Can Tho University of Medicine and Pharmacy, Can Tho, Vietnam
[4]Groningen Research Institute of Pharmacy, University of Groningen, Groningen, The Netherlands

*Correspondence: Thang Nguyen, Department of Pharmacology and Clinical Pharmacy, Can Tho University of Medicine and Pharmacy, 179 Nguyen Van Cu Street, An Khanh, Ninh Kieu, Can Tho, Vietnam. Email: nthang@ctump.edu.vn
‡Co-first authors.

Abstract

Objectives We aimed to assess whether a pharmacist-led intervention enhances knowledge, medication adherence and glycemic control in patients with type 2 diabetes mellitus (T2DM).

Methods We conducted a single-blinded randomized controlled trial in Vietnam. Individuals with T2DM were recruited from a general hospital and randomly allocated to intervention and routine care. The intervention group received routine care plus counselling intervention by a pharmacist, including providing drug information and answering individual patients' queries relating to T2DM and medications, which had not been done in routine care. We assessed the outcomes: knowledge score as measured by the Diabetes Knowledge Questionnaire, self-reported adherence and fasting blood glucose (FBG) at the 1-month follow-up.

Key findings A total of 165 patients (83 intervention, 82 control) completed the study; their mean age was 63.33 years, and 49.1% were males. The baseline characteristics of the patients were similar between the groups. At 1-month follow-up, the pharmacist's intervention resulted in an improvement in all three outcomes: knowledge score [B = 5.527; 95% confidence intervals (CI): 3.982 to 7.072; $P < 0.001$], adherence [odds ratio (OR) = 9.813; 95% CI: 2.456 to 39.205; $P = 0.001$] and attainment of target FBG (OR = 1.979; 95% CI: 1.029 to 3.806; $P = 0.041$).

Conclusions The pharmacist-led intervention enhanced disease knowledge, medication adherence and glycemic control in patients with T2DM. This study provides evidence of the benefits of pharmacist counselling in addition to routine care for T2DM outpatients in a Vietnam population.

Keywords: pharmacist-led intervention; knowledge; type 2 diabetes mellitus; Vietnam

Introduction

According to the World Health Organization (WHO), in most countries, the proportion of people with type 2 diabetes mellitus (T2DM) is increasing, from approximately 463 million adults with diabetes in 2019 to an expected 700 million by 2045. The majority of people diagnosed with diabetes come from low- and middle-income nations.[1] Diabetes is the leading cause of nephropathy, neuropathy, retinopathy and cardiac diseases – including peripheral arterial and cerebrovascular disease – and contributes to increased risks of infectious diseases such as tuberculosis.[1–3] Therefore, diabetes is likely to lead to poorer treatment outcomes when not properly managed.

Disease knowledge is considered the foundation of care for diabetes and glycemic control.[4] Effective education was shown to enhance attitudes and daily practices, especially lifestyle modifications and dietary management, resulting in better glycemic control and slowing diabetes progression and complications.[5–8] Many interventions, especially pharmacist-led interventions, have been developed to improve disease knowledge in patients with T2DM. A study conducted in India showed that counselling by pharmacists about diabetes could improve patients' knowledge of the disease.[9] Systematic reviews on pharmacist-led interventions demonstrated positive influences on the outcomes of diabetes mellitus – especially disease knowledge, self-care and reduction of HbA1c levels[10–13] – and its complications later on.[14, 15]

As a developing country, Vietnam is at an early stage in promoting hospital clinical pharmacy activities. The term 'Clinical pharmacy' was officially defined in the Law of Pharmacy in 2016 for the first time.[16] There are still many challenges in performing the clinical pharmacist's role, including providing drug information and counselling drug use.[17] These duties

Received: 26 August 2021 Accepted: 22 March 2022

are usually optional and have not been included in routine primary care for patients.

We conducted this study to assess the efficacy of pharmacist-led interventions for enhancing knowledge, medication adherence and glycemic control in patients with T2DM.

Materials and Methods

Study design and setting

A single-blinded, randomized controlled trial was conducted at Hau Giang General Hospital in Vietnam between 1 April and 15 August 2020. The primary outcome of the study was the score of diabetes knowledge in patients with T2DM; the secondary outcomes were the percentage of medication adherence and patients attaining the target fasting blood glucose (FBG). Both primary and secondary outcomes were measured at 1-month post-intervention.

Hau Giang General Hospital is a provincial hospital staffed by basic and high-qualified specialists with appropriate modern equipment. The hospital also supports district hospitals in developing professional techniques. Since 2013, a new facility with more than 600 beds has provided medical examination and treatment for more than 500 patients per day in Hau Giang province and the surrounding areas.

The study was approved by the institutional biomedical research ethics committee of Ho Chi Minh University of Medicine and Pharmacy (No. 347/HDDD-DHYD).

Study population, recruitment and randomization

Patients diagnosed with T2DM and treated in outpatient treatment were screened for eligibility. We included patients who: (1) had been treated with at least one diabetes medicine for at least the last 6 months, (2) were 18 years of age or older and (3) had undergone a FBG test. We excluded patients who: (1) were pregnant, (2) were unable to communicate in Vietnamese (foreign patients) or (3) had already participated in another study related to knowledge of diabetes. Recruitment took place between 1 April and 15 May 2020. Patients were approached at the Internal Medicine clinic of the Department of Examination, were invited to participate in the study and screened by the author (T.T.T.T). Informed consent was obtained from all study participants.

Randomization was conducted using an online random number generator. Patients were divided into four groups corresponding to gender and age: a <65-year-old female group, a ≥65-year-old female group, a <65-year-old male group and a ≥65-year-old male group. Random permuted blocks of two, four or six patients were produced for each group. Patients were randomly assigned to the control group or the intervention group, with equal numbers from each block.

Due to the characteristics of the intervention study, the pharmacist who delivered the intervention acknowledged whether the patient was in the intervention or control group (non-blinded). The investigators who collected the data from each patient before and after the intervention were blinded, and the counselling pharmacist and data collector were not the same people.

Routine care

Routine care for patients with T2DM consisted of a patient–physician appointment, scheduled every 4 weeks for patients with good glycemic control or every week for patients with poor glycemic control, to assess health status and glycemic control, to review medication and to make meeting arrangements. In addition, the patient also received advice from a nurse on how to administer the prescribed medications. The patients had their prescriptions filled at the hospital pharmacy or an outside private pharmacy and might have refills remaining until the next appointment with the physician.

Intervention

In the intervention group, in addition to usual care, the patient received counselling from a pharmacist in a face-to-face meeting. The consistency of the intervention was ensured by the fact that it was delivered by only one pharmacist and firmly adhered to the counselling consultation. The consultation content was developed by a pharmacist (author T.T.T.T.), with the consultation of the expert council consisting of six members (four clinical pharmacists and two specialists in kidney-endocrine diseases). The intervention comprised: (1) questions for evaluating the general T2DM knowledge of patients, and advice on: 2) diet and exercise advice, (3) self-monitoring of blood glucose, (4) diabetes-related complications, (5) diabetes foot care and (6) basic knowledge following American Diabetes Association (ADA)-2020 guidelines and the Guidelines for Diagnosis and Treatment of Diabetes Type 2 of Vietnam's Ministry of Health – 2017 (Supplementary Appendix 1).[18–20] Additionally, patients were provided with leaflets about diabetes. The clinical pharmacist (01) delivered the intervention to 2 to 3 patients in the intervention group per day, 45 min for each patient.

Data collection and outcomes

Recruited patients were interviewed at baseline by author T.T.T.T. and demographic characteristics (gender, age, education level and duration of diabetes) were recorded. Information on treatment was extracted from their medical records. Patients' diabetes knowledge and medication adherence were assessed by interview, using the translated and verified Diabetes Knowledge Questionnaire (DKQ) and the eight-item Morisky Medication Adherence Scale (MMAS-8), respectively. The DKQ was developed to measure outcomes of diabetes self-management education; it includes 24 questions with three responses for each (True, False and Unknown), and with 1 point given for each correct answer (Supplementary Appendix 2).[21] The permission of the DKQ author to translate and validate the Vietnamese version was obtained for this study. The MMAS-8 is a structured eight-question survey to measure self-reported adherence to medication through a series of short behavioural questions. The first seven items are given in yes/no questions, and the last item is scored on a 5-point Likert scale.[22] In this study, a score of <6 represented non-adherence, and a score of ≥6 was considered adherence (Supplementary Appendix 3). The MMAS-8 has been used widely in Vietnam, and permission was previously obtained from the author.[23]

One month after the intervention when the patients came back for a face-to-face meeting with the pharmacist, the outcomes were diabetes knowledge measured by DKQ score, medication adherence measured by MMAS-8 score, the proportion of patients who adhered to diabetes medications and the ratio of patients attaining the target FBG.

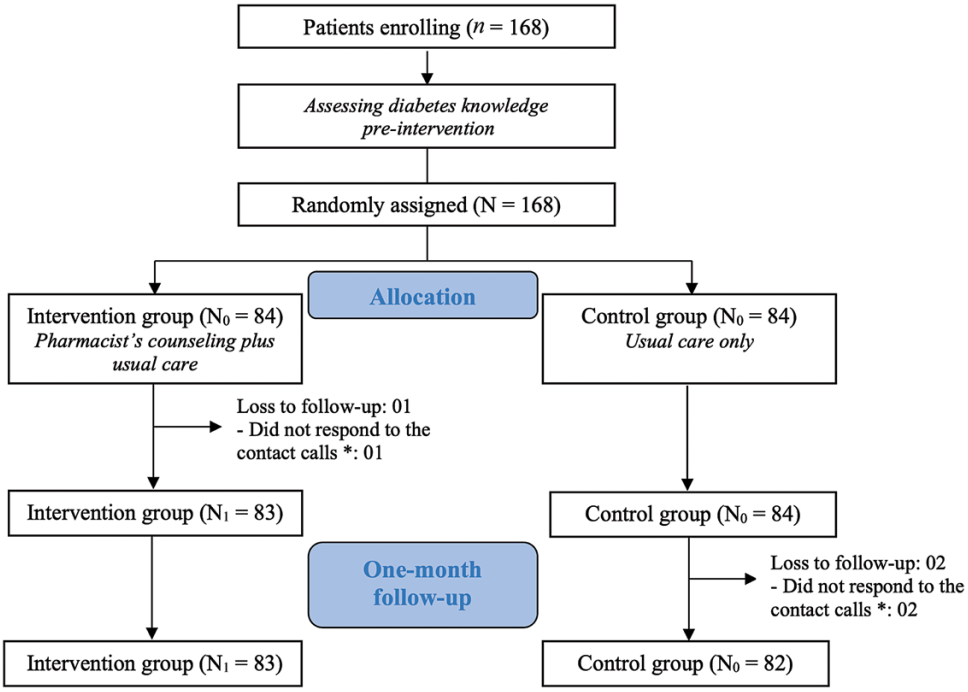

Figure 1 Flowchart of individuals participating in the study.

Sample size

We estimated the sample size based on the known mean score of knowledge of 12.99 in a previous study.[24] With a presumed knowledge score after the intervention of 16 (α = 0.05, β = 0.20), the sample size was calculated based on the probability of detecting an increase of 3.01 (SD = 5.62) in the knowledge score between the control and intervention groups, and to compensate for an expected loss to follow-up of 20%. A minimum of 132 patients were enrolled for both intervention and control groups (66 patients for each).

Data management and analysis

Microsoft Excel 2013 was used for data entry and storage. Data analyses were performed using Statistical Package for the Social Sciences version 20.0 (SPSS 20.0) and Microsoft Excel 2013 software. Data were expressed as frequencies and percentages, means ± standard deviations (SDs) as appropriate. Baseline characteristics of both groups were compared using a Chi-square test or Fisher's exact test for all categorical variables and an Independent *t*-test or Mann–Whitney test for all continuous variables. The difference in disease knowledge, adherence and attainment of target FBG between paired data of pre- and post-intervention in each group was assessed by the McNemar test (categorical) and the Wilcoxon signed-rank test (continuous). Multivariate linear regression analysis was used to determine the relationship between patient characteristics and pharmacist counselling on diabetes knowledge, with a 95% confidence interval (CI) for slope B. Similarly, multivariable logistic regression models were developed to estimate the odds ratio (OR) with 95% CI of the intervention and characteristics for the outcomes of adherence and attainment of target FBG. *P*-values less than 0.05 were considered statistically significant.

Results

Of the 168 patients enrolled in the study, 84 were randomized into the intervention group and 84 into the control group. A total of 165 patients completed the study. One patient in the intervention group and two patients in the control group were lost during follow-up, as they did not respond to the contact calls (Figure 1).

In both groups, the proportions of males and females were almost equal, with 50.9% and 49.1%, respectively. The under 65-year-old, 65-year-old and older age groups had similar proportions, with a mean age of 63.33 ± 14.12. The majority of patients had a primary education level (49.1%), had had diabetes for more than 10 years (58.8%) and had at least one comorbidity (83%). Patients were generally treated for diabetes with biguanide and sulfonylureas; metformin was used in 70.3% of patients and gliclazide in 54.5% of patients. The use rate of insulin in this study was 23.6%. For most patients, combination therapy for diabetes was indicated (60.6%) (Table 1). Metformin monotherapy was the highest among single-drug medications, at 12.7%. Sulfonylurea was indicated in both mono- and combination therapy. The patient's baseline characteristics were similar between groups ($P > 0.05$).

Initially, the mean DKQ score of the study population was 12.25 ± 5.55 for both groups. At 1 month after the intervention, a significant improvement was observed in the intervention group, in which the mean DKQ score increased from 12.19 ± 5.59 to 18.20 ± 6.92. Meanwhile, there was no considerable improvement in the control group ($P > 0.05$). Similarities were observed for the two secondary outcomes, including medication adherence and the percentage of patients achieving the FBG target. In the intervention group, the percentage of adherence had increased by 14.5%, compared with only 49.4% at the initial; the mean score of MMAS-8 had also reached 5.43 ± 2.08 at the 1-month follow-up. About

Table 1 Baseline characteristics of the study population

Patient characteristics		Overall (N = 165)		Group				*P*-value
				Intervention (N_1 = 83)		Control (N_0 = 82)		
		n	(%)	*n*	(%)	*n*	(%)	
Demographics and general characteristics								
Gender	Female	84	50.9	44	53.0	40	48.8	0.587
	Male	81	49.1	39	47.0	42	51.2	
Age (year), mean		63.33 ± 14.12		62.34 ± 14.27		64.34 ± 13.97		0.363
Ages	<65	79	47.9	42	50.6	37	45.1	0.481
	≥ 65	86	52.1	41	49.4	45	54.9	
Education	Primary	81	49.1	40	48.2	41	50.0	0.816
	Secondary or higher	84	50.9	43	51.8	41	50.0	
Disease characteristics								
Duration of disease	≤10 years	68	41.2	38	45.8	30	36.6	0.230
	>10 years	97	58.8	45	54.2	52	63.4	
Comorbidity	No	28	17.0	17	20.5	11	13.4	0.263
	1 Comorbidity	111	67.3	56	67.5	55	67.1	
	≥2 Comorbidities	26	15.7	10	12.0	16	19.5	
Treatment characteristics								
Drug choice								
Drugs used in the treatment of patients withtype 2 diabetes in this study:								
Biguanide	Metformin	116	70.3	58	69.9	58	70.7	0.831
Sulfonylureas	Gliclazide	90	54.5	46	55.4	44	53.6	
	Glimepiride	20	12.1	12	14.3	8	9.8	
Insulin	Insulin	39	23.6	16	19.2	23	28.0	
Therapy								
Number of drugs per day	1 drug	65	39.4	33	39.8	32	39.0	0.923
	≥ 2 drugs	100	60.6	50	60.2	50	61.0	
Insulin therapy	Yes	39	23.6	16	19.3	23	28.0	0.185
	No	126	76.4	67	80.7	59	72.0	
FBG								
Patients attaining target FBG		67	40.6	30	36.1	37	45.1	0.240
Disease knowledge								
DKQ score, mean		12.25 ± 5.55		12.19 ± 5.59		12.30 ± 5.55		0.961
Medication adherence								
Adherence		78	47.3	41	49.4	37	45.1	0.582
Non-adherence		87	52.7	42	50.6	45	54.9	
MMAS-8 score, mean		5.21 ± 1.78		5.29 ± 1.80		5.13 ± 1.78		0.554

63.9% of patients from the intervention group had the FBG target at the endpoint, which was about 1.8 times higher than baseline with 36.1%. In contrast, the control group did not show any significant change at 1 month after the intervention with two secondary outcomes ($P > 0.05$) (Table 2).

Multivariable regression analysis was conducted on factors that may affect disease knowledge scores, adherence and attaining FBG target after 1 month of both invention and control groups. Results showed that intervention by a pharmacist resulted in an improvement in all three outcomes: knowledge score (B = 5.527; 95% CI: 3.982 to 7.072; $P < 0.001$), adherence (OR = 9.813; 95% CI: 2.456 to 39.205; $P = 0.001$) and attainment of FBG target (OR = 1.979; 95% CI: 1.029 to 3.806; $P = 0.041$) at 1 month after the intervention. Patients with secondary education or higher had higher knowledge scores (B = 8.059; 95% CI: 6.478 to 9.640; $P < 0.001$), higher adherence scores (OR = 13.301; 95% CI: 3.803 to 46.501; $P < 0.001$) and greater ability to obtain the FBG target (OR = 2.503; 95% CI: 1.276 to 4.911; $P = 0.008$) than patients with a lower education level. Patients whose diabetes duration was more than 10 years were more likely to attain the FBG target (OR = 2.463; 95% CI: 0.965 to 6.287; $P = 0.059$) compared with patients whose disease duration was less than or equal to 10 years (Table 3).

Discussion

Main findings

The counselling intervention by pharmacists in our study increased the score regarding knowledge of T2DM by 6.01,

Table 2 Changes in outcomes at baseline and 1-month follow-up in control and intervention groups

Patient characteristics		Overall (N = 165)	Intervention group (N_1 = 83)	Control group (N_0 = 82)	*P*-value of difference between groups
DKQ score, mean					
Initial		12.25 ± 5.55	12.19 ± 5.59	12.30 ± 5.55	0.961
1-month follow-up		15.33 ± 6.93	18.20 ± 6.92	12.43 ± 5.65	<0.001
P-value of difference between time points			<0.001	0.109	
Medication adherence					
Initial	Adherence, *n* (%)	78 (47.3)	41 (49.4)	37 (45.1)	0.582
	MMAS-8 score, mean	5.21 ± 1.78	5.29 ± 1.80	5.13 ± 1.78	0.554
1-month follow-up	Adherence, *n* (%)	91 (55.2)	53 (63.9)	38 (46.3)	0.024
	MMAS-8 score, mean	5.43 ± 2.08	5.70 ± 2.31	5.16 ± 1.79	0.038
P-value of difference between time points in MMAS-8 score			0.024	0.157	
Attainment of target FBG					
Initial, *n* (%)		67 (40.6)	30 (36.1)	37 (45.1)	0.240
1-month follow-up, *n* (%)		92 (55.8)	53 (63.9)	39 (47.6)	0.035
P-value of difference between time points			<0.001	0.500	

the adherence rate in patients by 14.5% and the proportion of patients attaining the FBG target by 27.8% after 1 month. Primary education was associated with poor results in the knowledge score, adherence and attainment of the FBG target, and patients with a T2DM duration of less than or equal to 10 years were less likely to attain the FBG target.

Strengths and limitations

This study provides evidence of the benefits of a pharmacist-led intervention combined with routine care for T2DM outpatients in a Vietnam population. A strength of our study was its high-quality design, in which blinded data collection prevented bias in accessing T2DM knowledge and medication adherence via direct interviews. Both instruments used for outcome assessment – DKQ and MMAS-8 – were widely used, reliable tools for measuring patient disease knowledge and medication adherence. In addition, the DKQ was translated into Vietnamese and validated with 87 patients, thus assuring the accuracy and reliability of the assessment. This study also used the translated MMAS-8, which was previously cross-culturally adapted and validated for widely use with Vietnamese patients.[23] Our counselling intervention comprised a variety of contents in compliance with the guidelines of the ADA and the domestic authority, all of which have been shown to facilitate the knowledge, decision-making and mastery of skills necessary for optimal diabetes self-care, and to incorporate the needs, goals and life experiences of the person with T2DM.[20, 25, 26] An important feature for the practical application of our study is its favourable period of time – only one meeting, of about an hour, for the delivery of counselling content – creating convenience for both patients and counselling pharmacists. Moreover, as our study was conducted in a general hospital and not a specialist diabetes centre, it can easily be replicated in other healthcare facilities. Another aspect that makes this pharmacist-led intervention feasible is its use of inexpensive materials and equipment. The uncomplicated application of self-reported instruments and FBG measurement can successfully reflect the outcomes. Results from these tools can be a basis for further studies using more optimal clinical indicators such as HbA1C and admission rate.

Nonetheless, the findings in our study should be interpreted with caution for several reasons. One limitation of this study is its short follow-up period (1 month), and the single occasion of the intervention to assess changes in patients' knowledge, medication adherence and clinical outcomes such as the FBG. Even though certain changes were observed in expected directions in our intervention group, greater effects might have been observed if we had repeated the counselling meeting. Future studies with longer follow-up and repeated intervention would allow for assessment on a long-term basis. Moreover, patients might have received information about disease management from sources other than the pharmacist intervention during the intervention period, possibly interfering with the study outcomes. However, due to the short assessment period (1 month), the results between patients exposed to other sources of information may be insignificant and considered routine care. In addition, we only included patients treated with at least one diabetes medicine for at least 6 months and excluded patients who participated in another study related to diabetes knowledge, ensuring patients' preliminary and relatively equal knowledge and minimizing the influences on the knowledge results. Another factor that helps to control background confounders is the randomization applied. Furthermore, we performed the study in a single selected healthcare setting in a provincial urban centre of Vietnam; therefore, it may not be generalizable to rural and other urban settings. A further multicenter study involving more participants will produce more reliable and generalizable results. Also, no health economic assessments have been undertaken yet. For this reason, a cost-effectiveness analysis of the counselling scheme is suggested for economic evaluation.

Comparison with previous studies and probable interpretation

Some studies have demonstrated that intervention by healthcare providers exerts a positive influence on

Table 3 Multivariate regression analysis on influencing factors of diabetes knowledge, medication adherence and attainment of target FBG at1 month

Variables		Diabetes knowledge[1]			Medication adherence[2]			Attainment of target FBG at 1 month[2]		
		B	95% CI	*P*-value	OR	95% CI	*P*-value	OR	95% CI	*P*-value
Group	Control	5.527	3.982 to 7.072	<0.001	1	2.456 to 39.205	0.001	1	1.029 to 3.806	0.041
	Intervention				9.813			1.979		
Gender	Female	−0.719	−2.376 to 0.939	0.393	1	0.436 to 4.328	0.588	1	0.355 to 1.459	0.362
	Male				1.373			0.720		
Ages	<65 years	1.163	−0.980 to 3.307	0.285	1	0.680 to 15.131	0.141	1	0.272 to 1.720	0.419
	≥65 years				3.208			0.683		
Education level	Primary	8.059	6.478 to 9.640	<0.001	1	3.803 to 46.501	<0.001	1	1.276 to 4.911	0.008
	Secondary or higher				13.301			2.503		
Duration of diabetes	≤10 years	−1.052	−3.217 to 1.113	0.339	1			1		
	>10 years				1.909	0.403 to 9.051	0.415	2.463	0.965 to 6.287	0.059
Comorbidity	No	−0.442	−2.689 to 1.804	0.698	1	0.223 to 5.986	0.864	1	0.278 to 1.891	0.511
	Yes				1.155			0.725		
Number of drugs/day	1 drug	0.695	−0.933 to 2.322	0.401	1	0.492 to 4.815	0.458	1	0.460 to 1.823	0.803
	≥2 drugs				1.539			0.916		
Insulin therapy	No	−0.180	−2.114 to 1.753	0.584	1	0.409 to 5.864	0.519	1	0.285 to 1.453	0.289
	Yes				1.549			0.643		

[1]Multivariate linear regression analysis.
[2]Multivariable logistic regression analysis.

diabetes-related knowledge in patients. A study in Thailand showed that the mean DKQ score in the intervention group increased from 10.7 to 17.1 ($P < 0.001$) after 5 weeks and slightly declined to 16.5 ($P < 0.001$) after 13 weeks.[26] A similar tendency was observed in a previous study, in which the mean DKQ score in the intervention group increased from 15.41 to 18.49 (>three-question increase) from baseline to 3 months, and then decreased to 17.46 (one-question decrease) between the 3-month and 6-month interviews.[27] A study in the USA reported that the mean knowledge score in the intervention group increased from 13.66 to 15.71 ($P < 0.001$) after 3 months.[21] The similarity between our study and those above may result from using the same intervention method of direct counselling and the DKQ as an assessment method.

We found that patients with education levels of secondary school and higher have better disease knowledge than those with lower education levels. This result is in line with previous research.[21, 26] Highly educated patients may look for more information about their disease. As the education level was similar in our two groups, this factor did not affect the intervention outcome in our study. This result suggested that patients with low education have limited knowledge of T2DM and do not realize the consequences of diabetes. Healthcare providers need to give additional counselling to patients with low education, helping them understand more about the disease, thereby improving adherence to medications and achieving greater treatment efficiency.[28]

Our intervention also enhanced patients' medication adherence, although the improvement was modest (7.9%); however, another study showed a significant association between non-adherence and lack of diabetes-related knowledge.[28] The modest improvement in our study may be because our counselling content did not include the impact of non-adherence to treatment but referred mainly to basic knowledge of the disease, diet and exercise, blood glucose monitoring and complications. This finding can be further explained by the fact that most patients strongly believe that anti-diabetes medications are necessary for their current and future health.[28] In our study, patients with an education level of secondary school or higher had better adherence than those with lower education levels. This result is similar to that of a previous study.[29] Another study in Saudi Arabia found that 64.5% of patients with good adherence levels had had an intermediate education or higher: 9.7% had intermediate education, 29.0% were high school graduates and 25.8% had college degrees or higher.[30] This result may be because patients with higher education have better diabetes-related knowledge and realize the importance of the treatment.

After 1 month, it was evident that the pharmacist-led intervention improved disease knowledge and medication adherence and resulted in treatment effectiveness. Previous systematic reviews suggested that a decrease in blood glucose occurred in the intervention group between baseline and final follow-up compared with the control group.[12, 31] However, many other factors may also be involved in controlling patients' blood sugar.[32, 33] An association between disease knowledge and glycemic control was shown in a study conducted in Pakistan.[33] This study also found that patients with a prolonged duration of diabetes were more likely to achieve targets. A possible reason for this is that patients with longer duration may recognize the importance of glycemic control because they have experienced complications, and the daily routine of medication has become a habit.[34]

Conclusion

The intervention involving counselling by a pharmacist improved the knowledge of patients with T2DM, enhanced medication adherence and increased the likelihood of achieving the target FBG. This study highlights the need to offer counselling by healthcare providers to enhance disease knowledge in diabetic patients, especially those with low education levels, to help them better understand the disease, thereby increasing their adherence and the effectiveness of treatment. On the other hand, with an increasing number of patients obtaining the FBG target, the findings of this study may promote effective cooperation between physicians and clinical pharmacists in patient education to achieve expected therapeutic outcomes in treatment for T2DM patients.

Supplementary Material

Supplementary data are available at *International Journal of Pharmacy Practice* online.

Acknowledgements

The authors are grateful to the physicians and patients who participated in this study. We thank you for the University of Medicine and Pharmacy support at Ho Chi Minh City, Can Tho University of Medicine and Pharmacy, and Hau Giang General Hospital.

Author Contributions

All authors contributed to the study's conception and design. Material preparation, data collection and analysis were performed by T.H.N., T.T.T.T., K.T., S.T.P., T.N. and S.D.V. The first draft of the manuscript was written by N.K.N. and H.G.D. All authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding

No funding was received for conducting this study.

Conflicts of Interest

The authors have no conflict of interest to declare.

Ethics Approval

The study was approved by the Ethical Council of Ho Chi Minh City Medicine and Pharmacy University. All information of study participants was encrypted and kept privately, used only for research purposes.

Consent to Participate

Informed consent was obtained from participants.

Consent for Publication

The participants have consented to the submission of the study to the journal.

Data Availability

Data will be available on request from the authors.

References

1. International Diabetes Federation. *IDF Diabetes Atlas*. 9th edn. Brussels, Belgium: International Diabetes Federation; 2019.
2. World Health Organization. *Global Report on Diabetes*. France: World Health Organization, 2016.
3. World Health Organization. *Diagnosis and Management of Type 2 Diabetes (HEARTS-D)*. Geneva, Switzerland: World Health Organization; 2020.
4. Parker R, Williams M, Weiss B et al. Health literacy: report of the council on scientific affairs. *J Am Med Assoc* 1999; 281: 552–7. https://doi.org/10.1001/jama.281.6.552
5. Chawla SS, Kaur S, Bharti A et al. Impact of health education on knowledge, attitude, practices and glycemic control in type 2 diabetes mellitus. *J Fam Med Prim Care* 2019; 8: 261–8. https://doi.org/10.4103/jfmpc.jfmpc_228_18
6. Solanki J, Sheth N, Shah C et al. Knowledge, attitude, and practice of urban Gujarati type 2 diabetics: prevalence and impact on disease control. *J Educ Health Promot* 2017; 6: 1–7. https://doi.org/10.4103/jehp.jehp_101_15
7. Royal College of Pediatrics and Child Health. *Curriculum for paediatric training community child health – level 1, 2 and 3 Training*. Sydney, Australia: The Royal Australasian College of Physicians (RACP); 2010, 1–176.
8. Nazir SUR, Hassali MA, Saleem F et al. Medication management program: adherence, disease-related knowledge, health-related quality of life, and glycemic control for type 2 diabetes mellitus. *Altern Ther Health Med* 2020; 26: 4–10.
9. Malathy R, Narmadha MP, Ramesh S et al. Effect of a diabetes counseling programme on knowledge, attitude and practice among diabetic patients in Erode district of South India. *J Young Pharm* 2011; 3: 65–72. https://doi.org/10.4103/0975-1483.76422
10. Chrvala CA, Sherr D, Lipman RD. Diabetes self-management education for adults with type 2 diabetes mellitus: a systematic review of the effect on glycemic control. *Patient Educ Couns* 2016; 99: 926–43. https://doi.org/10.1016/j.pec.2015.11.003
11. Gucciardi E, Chan VWS, Manuel L et al. A systematic literature review of diabetes self-management education features to improve diabetes education in women of Black African/Caribbean and Hispanic/Latin American ethnicity. *Patient Educ Couns* 2013; 92: 235–45. https://doi.org/10.1016/j.pec.2013.03.007
12. Pousinho S, Morgado M, Falcão A et al. Pharmacist interventions in the management of type 2 diabetes mellitus: a systematic review of randomized controlled trials. *J Manag Care Spec Pharm* 2016; 22: 493–515. https://doi.org/10.18553/jmcp.2016.22.5.493
13. Wubben DP, Vivian EM. Effects of pharmacist outpatient interventions on adults with diabetes mellitus: a systematic review. *Pharmacotherapy* 2008; 28: 421–36. https://doi.org/10.1592/phco.28.4.421
14. Iqbal M, Khan A, Syed Sulaiman S. A review of pharmacist-led interventions on diabetes outcomes: an observational analysis to explore diabetes care opportunities for pharmacists. *J Pharm Bioallied Sci* 2019; 11: 299–309. https://doi.org/10.4103/jpbs.JPBS_138_19
15. van Eikenhorst L, Taxis K, van Dijk L et al. Pharmacist-led self-management interventions to improve diabetes outcomes. A systematic literature review and meta-analysis. *Front Pharmacol* 2017; 8: 1–14. https://doi.org/10.3389/fphar.2017.00891
16. National Assembly of Vietnam. *Law on Pharmacy No.105/2016/QH13*. Hanoi, Vietnam: National Assembly of Vietnam; 2016.
17. Nguyen-Thi HY, Nguyen-Ngoc TT, Le NH et al. Current status of clinical pharmacy workforce, services and clinical pharmacist recruitment in Ho Chi Minh City, Vietnam. *Int J Health Plann Manage* 2020; 35: 1205–18. https://doi.org/10.1002/hpm.3029
18. Vietnam's Ministry of Health. *Guidelines for the Diagnosis and Treatment of Type 2 Diabetes*. Hanoi, Vietnam: Vietnam's Ministry of Health; 2017, 1–37.
19. American Diabetes Association. Facilitating behavior change and well-being to improve health outcomes: Standards of Medical Care in Diabetes-2020. *Diabetes Care* 2020; 43:S48–65. https://doi.org/10.2337/dc20-S005
20. American Diabetes Association. Classification and diagnosis of diabetes: Standards of Medical Care in Diabetes-2020. *Diabetes Care* 2020; 43:S14–31. https://doi.org/10.2337/dc20-S002
21. Garcia AA, Villagomez ET, Brown SA et al. The Starr County Diabetes Education Study. *Diabetes Care* 2001; 24: 16–21. https://doi.org/10.2337/diacare.24.1.16
22. Morisky DE, Ang A, Krousel-Wood M et al. Predictive validity of a medication adherence measure in an outpatient setting. *J Clin Hypertens* 2008; 10: 348–54. https://doi.org/10.1111/j.1751-7176.2008.07572.x
23. Nguyen T, Nguyen TH, Pham ST et al. Translation and cross-cultural adaptation of the Brief Illness Perception Questionnaire, the beliefs about medicines questionnaire and the Morisky Medication Adherence Scale into Vietnamese. *Pharmacoepidemiol Drug Saf* 2015; 24: 159–60. https://doi.org/10.1111/tmi.13312
24. Tran TTT, Nguyen T, Nguyen TH et al. Factors related to disease knowledge in type 2 diabetes outpatient patients at Hau Giang Province General Hospital. *Ho Chi Minh City J Med* 2020; 24: 137–43.
25. Butt M, Mhd Ali A, Bakry MM et al. Impact of a pharmacist led diabetes mellitus intervention on HbA1c, medication adherence and quality of life: a randomised controlled study. *Saudi Pharm J* 2016; 24: 40–8. https://doi.org/10.1016/j.jsps.2015.02.023
26. Wichit N, Mnatzaganian G, Courtney M et al. Randomized controlled trial of a family-oriented self-management program to improve self-efficacy, glycemic control and quality of life among Thai individuals with type 2 diabetes. *Diabetes Res Clin Pract* 2017; 123: 37–48. https://doi.org/10.1016/j.diabres.2016.11.013
27. Sixta CS, Ostwald S. Texas-Mexico border intervention by promotores for patients with type 2 diabetes. *Diabetes Educ* 2008; 34: 299–309. https://doi.org/10.1177/0145721708314490
28. Sweileh WM, Zyoud SH, Abu Nab'A RJ et al. Influence of patients' disease knowledge and beliefs about medicines on medication adherence: findings from a cross-sectional survey among patients with type 2 diabetes mellitus in Palestine. *BMC Public Health* 2014; 14: 1–8. https://doi.org/10.1186/1471-2458-14-94
29. Bui TA, Nguyen T, Nguyen TH et al. Effectiveness of pharmacist's intervention on medication adherence of type 2 diabetic patients in Hau Giang Province General hospital. *Ho Chi Minh City J Med* 2020; 20: 114–21.
30. Ahmed NO, Abugalambo S, Almethen GH. Adherence to oral hypoglycemic medication among patients with diabetes in Saudi Arabia. *Int J Health Sci* 2017; 11: 45–9.
31. Shareef J, Fernandes J. Evaluating the effect of pharmacist's delivered counseling on medication adherence and glycemic control in patients with diabetes mellitus. *J Diabetes Metab* 2016; 7, 1–4. https://doi.org/10.4172/2155-6156.1000654
32. Bukhsh A, Mehmood Khan T, Sarfraz Nawaz M et al. Association of diabetes knowledge with glycemic control and self-care practices among Pakistani people with type 2 diabetes mellitus. 2019; 12, 1409–17. https://doi.org/10.2147/DMSO.S209711
33. Shams N, Amjad S, Seetlani NK et al. Diabetes knowledge in elderly type 2 diabetes mellitus patients and association with glycemic control. *J Liaquat Univ Med Heal Sci* 2016; 15: 71–7.
34. Shrestha NY. Diabetes knowledge and associated factors among diabetes patients in Central Nepal. *Int J Collab Res Intern Med Public Heal* 2015; 7: 82–91.