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RESEARCH ARTICLE

The effect of cognitive decline on the medication adherence in patients with type II diabetes mellitus

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Abstract

Background: Type II Diabetes Mellitus (T2DM) is a risk factor for decreased cognitive function that is rarely recognised by patients, apart from age and other factors. **Objective:** This study aims to assess the effect of decreased cognitive function on medication adherence in T2DM patients. **Method:** This study used a cross-sectional design conducted at the Pasar Minggu Community Health Center, Jakarta, Indonesia. Cognitive function was assessed using the validated Indonesian version of the Montreal Cognitive Assessment (MoCA-Ina) questionnaire. **Results:** One hundred twenty-seven T2DM patients (75.6% female) with a mean age of 58.69 years were recruited. The proportion of T2DM patients with decreased cognitive function was quite high, namely 61%. The proportion of non-adherent patients in the group with decreased cognitive function (70.6%) was greater than in the normal group (29.4%). Decreased cognitive function significantly affected non-adherence in taking medication with aOR 3.744 (95% CI 1.485–9.442), p = 0.005, after controlling for age, education level, HbA1c value, and comorbid dyslipidemia. **Conclusion:** Patients with decreased cognitive function are 3.7 times more likely to be non-compliant with medication, regardless of age, education level, HbA1c value, and dyslipidemia. Special management is needed for T2DM patients with decreased cognitive function, such as caregiver assistance, education by pharmacists, and simpler drug regimes.

Introduction

Diabetes mellitus (DM) is a risk factor for cognitive dysfunction and neurodegeneration (Xiang *et al.*, 2021). Type 2 DM (T2DM) patients experience higher declined cognitive function compared to those who do not suffer from the disease. DM affects several cognitive domains, decreasing neuropsychological performance and memory (Koekkoek *et al.*, 2015). The same finding was made by Xue *et al.*, showing that cognitive dysfunction caused by DM affects executive function and memory (Xue *et al.*, 2019). For patients with diabetes, this function is critical because it involves behavior such as awareness of problems, problemsolving, and decisions to stop or change old habits and start new ones. These behaviours are essential when patients are asked to perform complex tasks such as predicting the impact of physical activity on blood glucose and recognising and managing hypoglycemia appropriately (Munshi, 2017). DM is associated with long-term complications in the brain that manifest in worsening cognitive abilities and other abnormalities observed in brain imaging (Biessels *et al.*, 2021). Research conducted on 95 type 2 DM patients suspected of having impaired cognitive function found that 49% experienced disturbances in at least one domain, with memory being the most frequent (Groeneveld *et al.*, 2018).

The success of a therapy depends on the effectiveness of the therapeutic regimen as long as the patient takes the medication as prescribed (Anghel, Farcas, & Oprean, 2019). DM management in patients with

impaired cognitive function requires closer attention because visuospatial/constructional ability, attention and language deficits have an impact on the self-care of diabetic patients, such as self-monitoring of blood glucose, adherence to medication, diet, exercise, as well as control appointments with doctors (Munshi, 2017; Low *et al*., 2020). In addition, it can affect communication between doctors and patients. The greater the awareness of health professionals of any cognitive impairment in DM patients, the better they will be at adapting specialised patient care management strategies (Low *et al*., 2020). Unfortunately, cognitive decline is usually undetected, or detected but not documented, in more than half of patients seen by primary care physicians (Morley *et al*., 2016). Therefore, it is important to research on the prevalence of cognitive function decline and its effect on medication adherence in T2DM patients to identify and solve problems related to poor medication adherence in such patients.

Methods

Design

This is an observational study employing a cross-sectional study design. The research was conducted at Pasar Minggu Primary health centre, Jakarta. Data collection was performed from October 2021 to February 2022. T2DM patients routinely seeking treatment at Pasar Minggu health center and ≥36 years old were deemed suitable for participation in the study if they could see, hear, and speak, read, and write, and communicate well. Patients with mental disorders who had been diagnosed with dementia and had psychiatric disorders such as depression based on the Beck Depression Inventory-II (BDI-II) were excluded. All the study subjects were screened for depression, cognitive function, and adherence to treatment regimens. The research has been granted an ethical approval number KET-875/UN2.F1/ETIK/PPM.00.02/2021.

Outcome and adherence measurement

The study outcome was patients' adherence. In this research, the authors used a multi methods, combination of the subjective and objective methods, to assess medication adherence. The subjective assessment referred to a patient self-report methods using the validated Indonesian version of the Adherence to Refills and Medications Scale (ARMS) questionnaire. The validated English questionnaire was translated into Bahasa Indonesia and had been tested in diabetes population in three primary healthcare facilities. Questionnaire validity and reliability was considered good considering a correlation value of >0.3 and Cronbach's alpha of 0.6 (Cahyadi *et al*., 2015). Meanwhile, the objective one was a pharmacy prescription refill method by calculating the proportion of days covered (PDC). The combination was expected to complement each other's shortcomings when used together.

Given that no method is considered a "*gold standard*" in evaluating adherence, choosing at least two methods can give results that are close to the actual situation (Forbes *et al*., 2018; Anghel *et al*., 2019). This is also based on our previous research that demonstrated proportion difference of adherence between ARMS and PDC, thus combining both of the tools would be more reliable (Soraya *et al*., 2022). The authors stated someone as "*adhered*" if the result of ARMS score is 11 (Kripalani *et al*., 2009; Cahyadi *et al*., 2015) and PDC score at least 80% (Anghel *et al*., 2019). If a subject only meet one of each score criteria, the authors included them as "*non-adhered*".

Data collection

A total of 127 subjects were involved in this study. Sample size was calculated using formula as follows (Ogston *et al*., 1991):

$$\text{Sample size} = \frac{\left(z_{1-\alpha/2}\sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta}\sqrt{P_1(1-P_1)+P_2(1-P_2)}\right)^2}{(P_1-P_2)^2}$$

Description:

$Z_{1-\alpha/2}$ = The standard normal deviation (5% for type 1 error ($p < 0.05$) is 1.96)

$Z_{1-\beta}$ = The standard normal deviation for 80% power, type 2 error 20% is 0.842

P = (P1+P2)/2

P1 = Proportion of compliance in patients with decreased cognitive function

P2 = Proportion of compliance in patients with normal cognitive function

With a P1 value of 0.639 (Hayes, *et al*., 2010) and a P2 value of 0.88 (Kirkpatrick *et al*., 2014), the minimum sample size was 49 subjects per group. The sampling method was carried out by consecutive sampling.

Patients who met the inclusion criteria completed the BDI-II questionnaire to determine their depression status. If they had mild depression, as indicated by a BDI-II score ≥17 (Ginting *et al*., 2013), they excluded. Demographic data and data related to the patients' health condition were collected through direct interviews using standard questions from a questionnaire. Data was also collected from electronical medical records system. Furthermore,

interviews were conducted with patient to obtain demographic data and assess cognitive function using MoCA-Ina that has been validated by Husein *et al* (Husein, Lumempouw, & Ramli, 2010). Patients with a score of <26 was considered to have cognitive function declined (Nasreddine *et al*., 2005; Husein *et al*., 2010). MoCA has been approved as a screening tool for mild cognitive impairment (MCI) in Canada for the diagnosis and management of dementia to predict MCI in the elderly and individuals at high risk of developing dementia (Nasreddine *et al*., 2005).

The participants also completed the Indonesian version of the ARMS questionnaire to assess patient adherence (Cahyadi *et al*., 2015). After all the questionnaires had been completed, peripheral blood samples were taken to measure HbA1c levels using the Alere Afinion™ tool. Data were also obtained on patient visits during the last six months through the electronic medical records to calculate the PDC value within 180 days.

Data analysis

All the data collected were analyzed using bivariate and multivariate analysis. Bivariate analysis was conducted to analyze the association between cognitive function and medication adherence. Baseline characteristic differences between group was analysed using chi square for categorical and *t*-test or Mann-whitney for numerical variables depending on the data distribution. Association between cognitive function and medication adherence was performed using chi-square. In addition, multivariate analysis using logistic regression was performed to observe the association between the confounding variables and the dependent and independent ones. Before carrying out analysis using logistic regression, selection was carried out using bivariate analysis (Chi-square test) on dependent variable and covariates. Variables tested in the logistic regression were those with $p < 0.25$ and/or theoretically had an association with adherence (Hosmer *et al*., 2013). The authors built the multivariate model by removing the highest *p*-values one by one to see their effect on the dependent variable by calculating the change in OR. If the OR change was less than 10%, the independent variables were removed from the model. Eventually, the authors chose the model that had the narrowest confidence interval. All the data were statistically analysed using the Statistical package for the social sciences (SPSS), version 22.0.

Results

The study involved 127 T2DM patients as the research subjects; their characteristics are shown in Table I. Overall, cognitive function decline was found in 61% (78/127) of the study subjects. Subjects were dominated by women with an average age of 58 years. The education level of subjects with cognitive declined were significantly lower than the normal group ($p = 0.039$). Many of our research subjects were overweight to obese (63%) with a median value of 26.30 (min-max 18.36 – 42.58). There were 46.5% of the study subjects had type 2 DM for more than 5 years, and more than half of the study subjects consumed metformin-glimepiride combination (52%). However, only 24.4% of the study subjects have a good glycemic control, as shown by HbA1c less than 7%. The majority of study subjects has comorbidities in hypertension (63%) and dyslipidemia (63.8%). One patient may suffer from comorbid hypertension as well as dyslipidemia.

Overall, the percentage of patients who adhered to their medication in this study was only 33% (42/127). Adherence was more common in those with a level of education of >12 years. The non-adherent group were more likely to take metformin-glimepiride combinations and consumed more than 4 medicines in a day. Most non-adherent patients had uncontrolled blood glucose levels, as evidenced by the HbA1c value of ≥7 (Table II).

The proportion of adhered subjects in decreased cognitive function group (42%) assessed by the ARMS questionnaire was significantly smaller than in normal cognitive function group (58%). In contrast to the ARMS questionnaire, when medication adherence was assessed by PDC calculations, the proportion of adhered subjects in decreased cognitive function group (62.2%) was actually greater than in normal cognitive function group (37.8%) but not statistically significant ($p = 0.893$). When the two methods were combined to assess medication adherence, the proportion of adhered subjects in decreased cognitive function group (42.9%) was significantly smaller than in normal cognitive function group (57.1%) (OR 3.2; 95% CI [1.483 – 6.903] $p = 0.005$) (Table III). Likewise, the results remained significant when controlling for the confounding variables (OR 3.744; 95% CI [1.485 – 9.442] $p = 0.005$) (Table IV).

Table I: Demographic and clinical characteristics of research subjects

Variable	Cognitive function		Total (n=127) N (%)	*p*-value
	Declined (n=78) N (%)	Normal (n=49) N (%)		
Demographic variables				
Sex				
Male	21 (26.9)	10 (20.4)	31 (24.4)	0.535[#]
Female	57 (73.1)	39 (79.6)	96 (75.6)	
Age (Mean ± SD)	59.83 ± 8.67	56.86 ± 6.72	58.69 ± 8.08	0.043[¶]*
Education level				
>12 years	35 (44.9)	32 (65.3)	67 (52.8)	0.039[#]*
≤12 years	43 (55.1)	17 (34.7)	60 (47.2)	
DM-related factor				
Duration of DM				
≤5 years	40 (51.3)	28 (57.1)	68 (53.5)	0.644[#]
>5 years	38 (48.7)	21 (42.9)	59 (46.5)	
OAH agents				
Metformin	26 (33.3)	24 (49.0)	50 (39.4)	
Metformin-Glimepiride	44 (56.4)	22 (44.9)	66 (52.0)	0.199[#]
Others	8 (10.3)	3 (6.1)	11 (8.7)	
HbA1c level (%)				
Median (min-max)	7.75 (5.2 – 15.0)	8.30 (5.9 – 14.3)	7.90 (5.2 – 15.0)	0.645[§]
HbA1c ≥7	56 (71.8)	40 (81.6)	96 (75.6)	0.296[#]
HbA1c <7	22 (28.2)	9 (18.4)	31 (24.4)	
Vascular risk factor				
BMI, kg/m² (median, min-max)	25.61 (18.36 – 42.58)	26.77 (21.22 – 39.80)	26.30 (18.36 – 42.58)	0.236[§]
Thin-normal	29 (37.2)	18 (36.7)	47 (37.0)	1.000[#]
Overweight-obesity	49 (62.8)	31 (63.3)	80 (63.0)	
Hypertension				
No	23 (29.5)	24 (49.0)	47 (37.0)	0.043[#]*
Yes	55 (70.5)	25 (51.0)	80 (63.0)	
Dyslipidemia				
No	25 (32.1)	21 (42.9)	46 (36.2)	0.297[#]
Yes	53 (67.9)	28 (57.1)	81 (63.8)	
Tobacco use				
No	62 (79.5)	47 (95.9)	109 (85.8)	0.020[#]*
Yes	16 (20.5)	2 (4.1)	18 (14.2)	

[#]Analysis with Chi-Square; [¶]Analysis with *t*-test; [§]Analysis with Mann-whitney; *Significant, *p*-value < 0.05; DM = Diabetes Mellitus; OAH = Oral Antihyperglycemic; BMI = Body mass index.

Tabel II: Association between variables and medication nonadherence

Variables	Medication adherence		*p*-value[#]	OR (95% CI)
	Nonadherence (n=85) N (%)	Adherence (n=42) N (%)		
Sex				
Male	18 (58.1)	13 (41.9)	0.324	Ref
Female	67 (69.8)	29 (30.2)		0.599 (0.260 – 1.383)
Age				
≤65 years	62 (65.3)	33 (34.7)	0.638	Ref
>65 years	23 (71.9)	9 (28.1)		0.735 (0.305 – 1.770)
Education level				
>12 years	38 (56.7)	29 (43.3)	0.017*	Ref
≤12 years	47 (78.3)	13 (21.7)		0.362 (0.166 – 0.792)
Duration of DM				
≤5 years	47 (69.1)	21 (30.9)	0.709	Ref
>5 years	38 (64.4)	21 (35.6)		1.237 (0.590 – 2.594)

Variables	Medication adherence		*p*-value[#]	OR (95% CI)
	Nonadherence (n=85) N (%)	Adherence (n=42) N (%)		
Number of daily pills				
1-4	19 (51.4)	18 (48.6)	0.029*	Ref
>4	66 (73.3)	24 (26.7)		0.384 (0.173 – 0.851)
OAH agents				
Metformin	28 (56.0)	22 (44.0)	0.010*	
Metformin-Glimepiride	52 (78.8)	14 (21.2)		-
Others	5 (45.5)	6 (54.5)		
HbA1c level (%)				
HbA1c ≥7	72 (75.0)	24 (25.0)	0.001*	Ref
HbA1c <7	13 (41.9)	18 (58.1)		4.154 (1.776 – 9.718)
Hypertension				
No	32 (68.1)	15 (31.9)	0.987	Ref
Yes	53 (66.3)	27 (33.8)		1.087 (0.504 – 2.344)
Dyslipidemia				
No	25 (54.3)	21 (45.7)	0.038*	Ref
Yes	60 (74.1)	21 (25.9)		0.417 (0.194 – 0.894)
BMI (kg/m^2)				
Thin-normal	31 (66.0)	16 (34.0)	1.000	Ref
Overweight-obesity	54 (67.5)	26 (32.5)		0.933 (0.435 – 2.002)

[#]Analysis with Chi-Square; *Significant *p*-value < 0.05; Ref = Reference; DM = Diabetes mellitus; OAH = Oral antihyperglycemic; BMI = Body mass index

Tabel III: Association between cognitive decline and medication non-adherence

Medication nonadherence	Cognitive function		*p*-value[#]	OR (95% CI)
	Declined (n=78) N (%)	Normal (n=49) N (%)		
Based on ARMS				
Nonadherence	57 (74.0)	20 (26.0)	0.001*	Ref
Adherence	21 (42.0)	29 (58.0)		3.936 (1.844 – 8.400)
Based on PDC				
Nonadherence	17 (58.6)	12 (41.4)	0.893	Ref
Adherence	61 (62.2)	37 (37.8)		0.859 (0.369 – 1.999)
Based on ARMS+PDC				
Nonadherence	60 (70.6)	25 (29.4)	0.005*	Ref
Adherence	18 (42.9)	24 (57.1)		3.200 (1.483 – 6.903)

[#]Analysis with Chi-Square; *Significant, *p*-value < 0.05; Ref = Reference, ARMS = Adherence to refills and medications scale; PDC = Proportion of days covered

Tabel IV: The effect of other covariates on medication nonadherence

Model	Variables	Category	*p*-value[#]	OR	95% CI
Crude	Cognitive function	Normal	0.003*	Ref	1.483 – 6.903
		Declined		3.200	
Adjusted	Cognitive function	Normal	0.005*	Ref	1.485 – 9.442
		Declined		3.744	
	Age	≤65 years	0.409	Ref	0.548 – 4.383
		>65 years		1.550	
	Education level	>12 years	0.194	Ref	0.746 – 4.246
		≤12 years		1.780	
	HbA1c level	HbA1c <7	0.001*	Ref	2.071 – 14.978
		HbA1c ≥7		5.569	
	Dyslipidemia	No	0.108	Ref	0.857 – 4.797
		Yes		2.028	

[#]Analysis with logistic regression; *Significant, *p*-value < 0.05; Ref = Reference

Discussion

This research found two important things. First, there was a significant association between cognitive decline and medication nonadherence even after controlling covariates. Second, there was also a significant association between HbA1c levels and medication adherence. The significant association between cognitive decline and medication adherence have found in other studies (Kirkpatrick *et al*., 2014; Chudiak *et al*., 2018). However, there was previous study, which have not found a significant association between cognitive function and medication adherence (Rohde *et al*., 2019). This contradiction may be because the difference in the instruments used for assessing cognitive function and medication adherence, and also because of the uncontrolled factors that could influence the study results. Our study used multi methods in assessing medication adherence and try to identify and control confounding variables.

As previously known, DM is associated with long-term complications in the brain that manifest in worsening cognitive abilities (Biessels *et al*., 2021) and most DM patients are elderly. This makes DM patients with cognitive decline require more attention in diabetes management because cognitive functions such as visuospatial/constructional abilities, attention and language deficits have an impact on diabetes patient self-care such as blood glucose monitoring, medication adherence, appointments with doctors and communication doctor-patient. Greater awareness by healthcare professionals about cognitive decline among diabetes patients is helping to individualise patient care and adapt better management strategies (Low *et al*., 2020).

The results of this study show that many T2DM patients had cognitive decline (61%). The mean age of the study subjects in the normal cognitive function group was 57 years (SD 6.72) and in the decreased cognitive function group was 60 years (SD 8.67). There was a significant difference between the ages of the normal cognitive function group and the decreased cognitive function group (p = 0.043), a fact which calls for special attention as it can be clinically significant (Biessels *et al*., 2021). As with age, significant differences were also seen in the education level group (p = 0.039). A higher level of education is a protective factor that contributes to cognitive maintenance and improvement and reduces the risk of cognitive decline (Shen *et al*., 2021). In addition, the level of education has a significant influence on individual development. Individuals with higher education have advantages in several social factors such as socioeconomic resources, social status, and career achievements which have a good effect on cognitive function (Lövdén *et al*., 2020). Vascular disease also plays an major role in all forms of cognitive deficiency (Kirkpatrick *et al*., 2014). Body mass index (BMI), hypertension, dyslipidemia, and smoking habits are risk factors for vascular disease, which the authors documented through patient interviews. One patient may suffer from both hypertension and dyslipidemia.

Poor medication adherence is a serious challenge to the self-management of DM among adults with DM, and its downstream effects will be multiplied if left unaddressed and will be manifested as increased incidence and prevalence of major complication and heavier disease and economic burdens of the disease (Xu *et al*., 2020). Most of our study subjects did not adhere to their medication. This is very likely to occur, considering that the factors that influence drug adherence are comprehensive and varied, ranging from ones related to the patients themselves, to the drugs used, and to factors related to health facilities (Polonsky & Henry, 2016; Smith *et al*., 2017). The multivariate analysis showed that several factors that significantly affect medication nonadherence include age, education level, HbA1c levels, and comorbid dyslipidemia.

Medication adherence was measured using two instruments, the ARMS questionnaire and the PDC calculation. The ARMS questionnaire represents the subjective method and the PDC calculation represents the objective method. The proportion of medication adherence assessed by the ARMS questionnaire in research subjects with decreased cognitive function (42%) was smaller than in research subjects with normal cognitive function (58%). This result is statistically significant with a p-value < 0.05. In contrast to the ARMS questionnaire, when medication adherence was assessed by PDC calculations, the proportion of study subject adherence to medication with decreased cognitive function was actually greater (62.2%) than research subjects with normal cognitive function (37.8%). However, these results were not significant because there was no significant difference between the two groups (p = 0.893). Differences in the proportion of adherence between methods also occur in other studies (Pandey *et al*., 2015; Cain *et al*., 2020). This can happen because the PDC calculation has limitations, it cannot ensure that the drug that the patient is redeeming is actually being taken (Forbes *et al*., 2018). When the two methods were combined to assess medication adherence, the proportion of medication adherence in the study subject group with decreased cognitive function (42.9%) was smaller than the study subject with normal cognitive function (57.1%). Just as when using the ARMS questionnaire, there was a significant difference between the two groups with a p < 0.05. Based on the Odds Ratio (OR) value, it is known that patients with decreased

cognitive function tend to be non-adherent in taking medication 3.2x compared to patients with normal cognitive function.

Multivariate analysis aims to see the effect of cognitive function and confounding variables (other independent variables) on medication adherence. This analysis was performed using logistic regression. Variables of cognitive function, gender, age, BMI, education level, number of drugs prescribed, type of oral antihyperglycemic drug, HbA1c level, and comorbid dyslipidemia were analyzed together for their effect on medication adherence. The results of the calculation of OR changes in the variables of sex, BMI, number of drugs prescribed, and type of oral antihyperglycemic drugs are less than 10% so that it can be concluded that these variables are not confounding variables that interfere with the relationship between cognitive function and adherence to taking medication. While the variables of age and education level have OR changes of more than 10% so that they are designated as confounding variables that interfere with the relationship between cognitive function and medication adherence.

Based on multivariate analysis, it is known that cognitive function decreases 3.7 times causing non-adherence to taking medication compared to normal cognitive function after controlling for age, education level, HbA1c levels, and comorbid dyslipidemia. In addition to cognitive function, HbA1c levels have a value of $p < 0.05$, which means that they have a significant relationship with medication adherence. Based on the OR value, it is known that patients who have HbA1c levels ≥7 tend to be non-compliant 5.5 times compared to patients who have HbA1c values <7.

In terms of HbA1c level, a research found approximately 75% of T2DM patients fail to achieve HbA1c levels of <7, with the main contributing factor being low adherence (Polonsky & Henry, 2016). Previous studies have found a close relationship between HbA1c and medication adherence (Lee *et al*., 2017; Lin *et al*., 2017). Decreased HbA1c values have been significantly associated with increased adherence (Capoccia *et al*., 2016). Improvements in HbA1c values are the basis for determining T2DM therapy. In addition, this can assist in the management of glycemic control and reduce the risk of DM complications, morbidity, and mortality (Gordon *et al*., 2018).

To overcome the problem of medication nonadherence, the role of the pharmacist is needed. One of them is by conducting counseling that motivates patients to remain compliant with the pharmacotherapy regimen they receive. In addition, identification of specific risk factors that cause patients to not adhere to taking medication is the role and responsibility of a pharmacist. After the identification process is carried out, the pharmacist can then play a role in adjusting interventions to modify the risk factors for non-adherence in each patient. For example, pharmacists can identify decreased cognitive function as a risk factor for non-adherence to taking medication in patients with type 2 DM. When a patient is identified as having decreased cognitive function, special management is needed, such as assistance from a caregiver or monitoring medication taking. Pharmacists can also communicate with doctors to propose the necessary therapy to overcome the decline in cognitive function experienced by type 2 DM patients.

Strengths and limitations of the research

Our research used the MoCA questionnaire as a cognitive function screening tool recognized as being relatively sensitive in assessing mild cognitive impairment (MCI) and is widely used in various countries. In addition, the authors employed a combination of subjective and objective methods to assess medication adherence in order to obtain a value close to the actual result. The ARMS questionnaire that the authors used to assess patient adherence can also assess medication and refilling-prescription adherence; likewise, the PDC calculation has advantages in assessing chronic disease drug adherence compared to other method (i.e. medication possession ratio).

This research has some limitations. It is a cross-sectional study design, which cannot determine the causality between cognitive decline and medication adherence. Second, it was conducted at one primary health facility so the results cannot be generalised. However, the results of this research are useful for study site and can be replicated elsewhere through a multicenter study. In addition, this study at one location helped researchers carry out tests of cognitive function, HbA1c, and medication adherence using the same method, thereby minimising information bias.

Conclusion

Patients with decreased cognitive function were 3.7 times more likely to be non-compliant with taking medication compared to patients with normal cognitive function, regardless of age, education level, HbA1c value, and dyslipidemia. These results indicate that there is a need for special management for T2DM patients with decreased cognitive function, such as through caregiver assistance, education by pharmacists, and simpler drug regimens.

Conflict of Interest

The authors declare no conflict of interest to disclose.

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