A Study on Medication Nonadherence Among Geriatric Patients with Diabetes Mellitus at Health Clinics in Marang District, Terengganu

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Abstract

Introduction: Type-2 Diabetes Mellitus (T2DM) was considered a global health condition that affected millions of geriatric populations with an increasing prevalence. Despite the clear advantages of medication adherence towards lowering the risks of mortality and vascular complications, the issues of medication nonadherence remained unsettled.

Objective: This study aimed to assess the rate of medication nonadherence and identify the factors associated with medication nonadherence among geriatric patients with diabetes mellitus in the health clinics of Marang District.

Methods: This cross-sectional study was conducted in six public health clinics in Marang district, Terengganu, involving geriatric patients diagnosed with diabetes mellitus. Data was collected from 1st June to 31st July 2023 using the Malaysia Medication Adherence Assessment Tool (MyMAAT) questionnaire. Multiple logistic regression analysis was performed to determine the factors associated with medication nonadherence.

Results: A total of 350 patients participated in the study. The majority of the patients were female (59.7%) and Malay (98.9%) with a mean age of 66.5 ± standard deviation of 5.2 years. A total of 187 (53.4%) the study population were nonadherent to their medications. Household income was the only variable that was significantly associated with nonadherence. Patients with household income above RM1,500 per month had lower odds of medication nonadherence (adjusted OR: 0.561; 95% CI: 0.349-0.901, *p*=0.017).

Conclusion: Half of the geriatric patients with diabetes who attended the public health clinics in Marang district were nonadherent to their medications. As low household income could be associated with medication nonadherence, further studies are needed to understand the factors behind so that strategies can be designed to improve medication adherence.

Keywords: Elderly, diabetes, medication nonadherence, medication adherence

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Introduction

In Malaysia, geriatric population is defined as individuals aged 60 years and above (1). This group has been categorised as one of the national health priorities because they were more likely to experience age-related diseases, higher morbidity, frequent healthcare service utilisation, greater risk of complications, and have a higher demand for specialised services (2). Increased life expectancy, coupled by the changes in the structure of the society, led to a growing number of elderly people living alone. Absence of family support may increase the likelihood of chronic diseases progressing both physically and mentally (3). A country with ageing population has its consequences especially related to health issues (4).

According to the 6th Edition Clinical Practice Guidelines on Management of Type 2 Diabetes Mellitus (T2DM) published in 2020, the management of diabetes involved lifestyle modification, taking medications as prescribed, and educating patients to promote empowerment and self-care. The guideline also stated an increasing prevalence of diabetes among younger individuals, with 4.3% and 5.4% among those aged between 18-19 years and 20-24 years, respectively. Despite that, the prevalence of diabetes was still highest among the elderly, with 42.4% among those age 60- 64, 43.4% among age 65-69, 40.6% among age 70-74% and 38.4% among those over 75 years old. The real burden of diabetes was due to the development of microvascular complications, for example eye and kidney disease, and macrovascular complications, such as coronary, cerebrovascular, peripheral vascular complications, which contributed to morbidity and mortality (5).

Long-term medications use was common in T2DM management. Although drugs were effective in treating diabetes, medication nonadherence was an obstacle to achieve full therapeutic benefits. The process of taking the medication as directed was defined as medication adherence (6). The issue of medication adherence was significant across all demographics and even more among the elderly (7). Almost 50% of geriatric patients with chronic conditions did not adhere to their prescribed drugs as been told by healthcare professionals (4). Low medication adherence in diabetic patients typically resulted in reduction of medication efficacy, poor clinical outcomes (in terms of glycaemic control), increased drug-related side effects, and increased social health care expenditures. Previous studies found that age, medication knowledge, the existence of comorbidities, family support, stress, satisfaction with medical care, and religious coping strategies were the factors impacting medication adherence among T2DM patients (8).

Comorbid conditions and prescription of multiple medications have been observed to reduce patients' adherence toward their medications (9). Based on a study from Iran, the percentage of patients with good adherence gradually declined as the number of comorbidities increased, from 20% in those without comorbid diseases to 11.1% in those with three to five comorbid conditions (10). Elderly patients at risk of nonadherence often had multiple comorbid conditions and were on numerous drugs (11). One of the findings from the study in Bangladesh implied that adherence significantly declined with age. In another study, 12.9% of the subjects in the 60–70 age range and 33.7% of those over 71 years old had low levels of adherence (10).

A study conducted in 2021 at the outpatient pharmacy of Sultan Ahmad Shah Medical Centre (SASMEC) in Pahang, Malaysia found that a total of 134 patients, mostly elderly (99%), returned 11,054 units of prescription medications, including pills, inhalers, insulin pens, bottles, and plastic containers, with a total value of 13,594.90 Ringgit Malaysia (RM), averaging RM101.45 per patient (12). The returning of unused medications might be one of the indicators of potential medication nonadherence. It is crucial to improve medication adherence in patients with chronic disease to reduce early mortality and social burden. Identifying the factors associated with medication adherence may guide healthcare professionals in developing interventions to improve adherence rates (8). Therefore, this study was conducted to assess the rate of medication nonadherence and to identify the factors associated with medication nonadherence among geriatric patients with diabetes mellitus at the public health clinics in Marang District.

Methods

This was a cross-sectional study among geriatric patients with T2DM who were receiving routine follow-up care at all six Ministry of Health (MOH) health clinics in Marang District, Terengganu, from 1st June to 31st July 2023. Ethical approval was obtained from the MOH Medical Research and Ethics Committee (MREC), and the study was registered in the National Medical Research Register (NMRR-23-01793-RR9).

The sample size was calculated using OpenEpi software. Considering 95% confidence interval (CI) with 5% of margin error and estimated proportion of 39.7% medication nonadherence rate in Malaysian primary care clinics (4), by allowing 20% drop out, the final sample size required was 350 geriatric patients.

Patients were recruited from the outpatient pharmacies at all six MOH health clinics in Marang District. The study included geriatric patients with T2DM who self-administered their medications and excluded those with cognitive impairment and illiteracy. Systematic random sampling was performed, in which every third patient attending outpatient pharmacy for medication collection appointments was approached and assessed for eligibility as the study participants throughout the study period. Trained pharmacists identified eligible patients that fulfilled the inclusion and exclusion criteria at the outpatient

pharmacy counter and invited them into the counselling room for further explanations about the study before recruiting them. All participants were given written and oral explanation on the purpose and methodology of the research, and confidentiality assurance. They were also assured that participation was voluntary and they could withdraw from the study at any time during the questionnaire completion without affecting their follow up at the clinic. Written informed consent was obtained prior to data collection. The questionnaire administration was guided by the trained pharmacists who underwent training about the study instrument in May 2023 to ensure consistent understanding of the questions. Each interview session lasted approximately 20 minutes.

Data were collected using a validated Malay version of Malaysia Medication Adherence Assessment Tool (MyMAAT) in which prior formal permission was obtained from the author (13). The tool comprises 12 questions that evaluate two different aspects of medication self-efficacy which were medication-taking behaviours related to nonadherence and the reasons for medication nonadherence. Each question employed five-point Likert-scale responses, ranging from ‘strongly agree’ to ‘strongly disagree’. The answers were scored, with each ‘strongly agree’ to ‘strongly disagree’ response assigned between one and five marks, respectively. A total score of 54 and above was considered good adherence, while score below 54 indicated moderate and poor adherence (13).

Data were analysed using SPSS version 27 for Windows. Categorical data were presented as frequencies (n) and percentages (%), while continuous data were presented as mean and standard deviation (SD). Simple logistic regression analysis was conducted to identify the variables associated with medication nonadherence. Variables with a *p*-value of <0.25 in the simple logistic regression were subsequently included in a multiple logistic regression model for further analysis to determine significant factors associated with medication nonadherence. The adjusted odds ratios (ORs) were presented, with a *p*-value of <0.05 considered statistically significant.

Results

A total of 420 geriatric patients were approached in this study and assessed for eligibility. Based on inclusion and exclusion criteria, the final number of respondents was 350, yielding a response rate of 83.3%. The mean ± SD age of patients was 66.5 ± 5.2 years, with the majority of them being female (59.7%), Malay (98.9%) and married (80.0%). Most of the participants completed secondary and tertiary education (51.7%), were non-employed (86.0%), and lived with family members (90.9%). Additionally, 99.1% of them had co-morbidities. The demographic data were tabulated in Table 1.

Table 1: Sociodemographic and disease characteristics of study population (n=350)

Variables	n (%)	Mean± SD
Age (year)		66.5 ± 5.2
≤ 65 years	175 (50.0)	
> 65 years	175 (50.0)	
Gender		
Male	141 (40.3)	
Female	209 (59.7)	
Ethnicity		
Malay	346 (98.9)	
Non-Malay	4 (1.1)	
Living situation		
Live alone	32 (9.1)	
Live with family members	318 (90.9)	
Educational level		
Informal / primary education	169 (48.3)	
Secondary / tertiary education	181 (51.7)	
Marital status		
Married	280 (80.0)	
Single / divorced	70 (20.0)	
Employment status		
Unemployed / retired	301 (86.0)	
Employed	49 (14.0)	
Household income (RM)		1,543.30 ± 1,996.80
≤ RM1,500	247 (70.6)	
> RM1,500	103 (29.4)	
Smoking status		
No	315 (90.0)	
Yes	35 (10.0)	
Comorbidities		
No	3 (0.9)	
Yes	347 (99.1)	
Duration of T2DM		
≤ 10 years	224 (64.0)	
> 10 years	126 (36.0)	
Number of medications		
≤ 5	160 (45.7)	
> 5	190 (54.3)	
Antidiabetic medications		
OGLD	123 (35.1)	
Insulin with or without OGLD	227 (64.9)	
Experienced side effects of medications		
No	279 (79.7)	
Yes	71 (20.3)	
Difficulties swallowing medications		
No	317 (90.6)	
Yes	33 (9.4)	

Abbreviation: T2DM = Type 2 Diabetes Mellitus; OGLD = Oral glucose-lowering drug; SD = Standard deviation

A total of 187 (53.4%) geriatric T2DM patients were categorised as having poor medication adherence with MyMAAT score less than 54, while 163 (46.6%) patients were having good adherence with MyMAAT score of 54 and higher. There was no statistically significant difference in the demographic characteristics between the medication adherence and nonadherence group, except for household income (p=0.042).

Table 2: Characteristics of adherence and nonadherence group (n=350)

Variables	Adherence, n (%) / mean ± SD (n=163)	Nonadherence, n (%) / mean ± SD (n=187)	*p*-value
Age (year)	66.88 ± 5.3	66.11 ± 5.1	0.164 [a]
≤ 65years	74 (45.4)	101 (54.0)	
> 65years	89 (54.6)	86 (46.0)	
Gender			0.344 [b]
Male	70 (42.9)	71 (37.9)	
Female	93 (57.1)	116 (62.1)	
Ethnicity			0.342 [c]
Malay	160 (98.2)	186 (99.5)	
Non-Malay	3 (1.8)	1 (0.5)	
Living situation			0.147 [b]
Live alone	11 (6.7)	21 (11.2)	
Live with family members	152 (93.3)	166 (88.8)	
Educational level			0.562 [b]
Informal / primary education	76 (46.6)	93 (49.7)	
Secondary / tertiary education	87 (53.4)	94 (50.3)	
Marital status			0.668 [b]
Married	132 (81.0)	148 (79.1)	
Single/ divorced	31 (19.0)	39 (20.9)	
Employment status			0.137 [b]
Unemployed / retired	145 (88.9)	93 (49.7)	
Employed	18 (11.1)	94 (50.3)	
Household income (RM)	1,775.2 ± 2,096.22	1,341.2 ± 1,888.5	0.042 [a, #]
≤ RM1,500	106 (65.0)	141 (75.4)	
> RM1,500	57 (35.0)	46 (24.6)	
Smoking status			0.239 [b]
No	150 (92.0)	165 (88.2)	
Yes	13 (8.0)	22 (11.8)	
Comorbidities			0.551 [c]
No	1 (0.6)	2 (1.0)	
Yes	162 (99.4)	185 (99.0)	
Duration of T2DM			0.459 [b]
≤ 10 years	101 (62.0)	123 (65.8)	
> 10 years	62 (38.0)	64 (34.2)	
Number of medications			0.238 [b]
≤ 5	80 (49.1)	80 (42.8)	
> 5	83 (50.9)	107 (57.2	
Antidiabetic medications			0.199 [b]
OGLDs	63 (38.7)	60 (32.1)	
Insulin with or without OGLD	100 (61.3)	127 (67.9)	
Experienced side effects of medications			0.106 [b]
No	136 (83.4)	143 (76.5)	
Yes	27 (16.6)	44 (23.5)	
Difficulties swallowing medications			0.892 [b]
No	148 (90.8)	169 (90.4)	
Yes	15 (9.2)	18 (9.6)	

[a] Independent t test; [b] Chi-square test; [c] Fisher's exact test; [#] statistically significant.
Abbreviation: T2DM = Type 2 Diabetes Mellitus; OGLD = Oral glucose-lowering drug; SD = standard deviation

Simple logistic regression analysis was conducted to identify the factors associated with medication nonadherence. Variables with a $p<0.25$ in simple logistic regression such as age, living situation, household income, smoking status, number of drugs, type of antidiabetic and side effects of drug were further analysed using multiple logistic regression. It was found that household income emerged as the only variable that was significantly associated with nonadherence (Table 3). Patients with a household income above

RM1,500 per month were less likely to be associated with nonadherence (adjusted OR: 0.561; 95% CI: 0.349-0.901, *p*=0.017) compared to the lower income group.

Table 3: Predictor of nonadherence among geriatric patients with diabetes mellitus (n=350)

Variables	Simple Logistic Regression			Multiple Logistic Regression [a]		
	(b)	Crude Odds Ratio (95% CIs)	p-value	(b)	Adjusted Odds Ratio (95% CIs)	p-value
Age						
≤ 65years	0	1.00		0	1.00	
> 65 years	-0.029	0.972 (0.933–1.012)	**0.164**	-0.038	0.963 (0.923-1.007)	0.075
Gender						
Male	0	1.00				
Female	0.207	1.230 (0.801-1.887)	0.344			
Ethnicity						
Malay	0	1.00				
Non-Malay	-1.249	0.287 (0.030-2.784)	0.281			
Living situation						
Live alone	0	1.00		0	1.00	
Live with family members	-0.559	0.572 (0.267-1.226)	**0.151**	-0.547	0.579 (0.264-1.271)	0.173
Educational status						
Informal / primary education	0	1.00				
Secondary / tertiary education	-0.124	0.883 (0.580-1.345)	0.562			
Marital status						
Married	0	1.00				
Single / divorced	0.115	1.122 (0.663-1.900)	0.668			
Employment status						
Unemployed / retired	0	1.00		0	1.00	
Employed	0.470	1.601 (0.858-2.985)	**0.139**	0.438	1.550 (0.822-2.922)	0.176
Household income						
≤ RM1,500	0	1.00		0	1.00	
> RM1,500	-0.500	0.607 (0.382-0.964)	**0.034**	-0.578	0.561 (0.349-0.901)	**0.017** [#]
Smoking status						
No	0	1.00		0	1.00	
Yes	0.431	1.538 (0.749-3.162)	**0.241**	0.391	1.478 (0.700-3.121)	0.306
Comorbidities						
No	0	1.00				
Yes	-0.560	0.571 (0.051-6.355)	0.649			
Duration of T2DM						
≤ 10 years	0	1.00				
> 10 years	-0.165	0.848 (0.547-1.313)	0.459			
Number of medications						
≤ 5	0	1.00		0	1.00	
> 5	0.254	1.289 (0.845-1.966)	**0.238**	0.292	1.339 (0.866-2.070)	0.189

Antidiabetic medications						
OGLD	0	1.00		0	1.00	
Insulin with or without OGLD	0.288	1.334 (0.859-2.071)	**0.200**	0.349	1.418 (0.903-2.225)	0.129
Experienced side effects of medications						
No	0	1.00		0	1.00	
Yes	0.438	1.550 (0.909-2.643)	**0.108**	0.440	1.553 (0.110-2.665)	0.108
Difficulties swallowing medication						
No	0	1.00				
Yes	0.050	1.051	0.892			

[a] Backward Multiple Logistic Regression model was applied; [#] statistically significant

Constant 2.839

Multicollinearity and interaction term were checked and not found

Hosmer-Lemeshow test, p=0.819, Classification table 57.1%; Area under ROC curve 0.59

Abbreviation: T2DM = Type 2 Diabetes Mellitus; OGLD = Oral glucose-lowering drug; CI = Confidence interval.

Discussion

In this study, the prevalence of medication nonadherence among geriatric patients with T2DM in Marang District, Terengganu was 53%. This was higher than the similar study findings reported from Muar, Johor (39.7%) (8) and Shandong province, China (19.9%) (14). Another study conducted in the state of Selangor found that up to 83.2% of their geriatric patients were not adherent to their medications as prescribed (15). These variations in the level of adherence could be attributed by the differences in data collection tools, population, healthcare systems, study design and participants' socioeconomic characteristics.

Household income was the only factor that was significantly associated with medication nonadherence among the diabetic geriatric patients in this study. Patients with monthly household income of RM1,500 and below were more likely to be nonadherent to their medications. Our findings were coherent with a previous study from Canada, where individuals with lower household income were more likely to exhibit nonadherence due to challenges in securing transportation to collect medication, along with the lack of family support compared to those in adherence groups (16,17). Financial limitations may hinder the access to necessary pharmacological therapy due to limited resources and transportation facilities to get the medications. This was particularly relevant for individuals requiring chronic medical care, such as geriatric patients with comorbidities who have regular follow-up visits to the healthcare facilities. This situation contributed to nonadherence, that could potentially lead to increased hospitalisation and additional medical costs.

Previous studies showed that patients with low economic status tend to discontinue their medications due to affordability issues (18). The costs of medications and transportation problems in low-income populations could contribute to medication nonadherence (19). Cost related nonadherence (CRNA) was reported to be common among diabetes patients, particularly when they were driven by financial stress and insecurity with healthcare (20). Although the medications provided in the Malaysia public sector health clinics were fully subsidised by the government, other costs that occur during the health services utilisation and medications collection process could hinder the patients from taking their medications as instructed (21). Therefore, the government together with non-governmental organisations (NGO) and healthcare professionals should collaborate to ensure the continuity of the treatment and reduce the risk of non-adherence.

Other characteristics such as age, gender, ethnicity, living situation, educational status, marital status, employment status, smoking status, comorbidity, duration of diabetes, number of drugs, types of antidiabetic drugs, and side effects did not show significant associations with medication nonadherence in this study. A study that was carried out in Muar, Johor also found no effect of gender on medication nonadherence (8). However, another study conducted in regional hospitals in Cameroon found that females were more likely than men to forget taking their medications, miss doses, put off filling the prescription, and request lower cost medication (22). Ethnicity was not associated with medication nonadherence in this study. However, previous study revealed that racial or ethnic differences might influence medication nonadherence

due to perceived differences in beliefs or knowledge about diabetes management (23). Education level and gender also showed no association with medication nonadherence. Similarly, a study conducted in Jordan (24) found that marital status and the presence of family members did not affect medication nonadherence among geriatric patients. Meanwhile, another study identified that external factors such as home and community environment, level of support related to these resources, and interpersonal connections, especially family support, were thought to be crucial components of a patient's resolve to take their medication as prescribed (7). Our study found that employment status was not associated with medication nonadherence, which was aligned with a previous study in China (14). Conversely, another study stated that the self-employed individual had a nearly eight-fold higher nonadherence rate, likely due to their hectic schedules and frequent travel (25)

In this cross-sectional study, the duration of diabetes treatment was not significantly associated with medication nonadherence. However, this was not consistent with another study where younger patients with shorter treatment durations showed higher medication nonadherence, typically due to insufficient understanding of the condition, apprehension about adverse effects, and the burden of following the regimens. Older patients with longer illness durations generally had greater knowledge about the condition, understood the need of glycaemic management to avoid complications, and received family support in managing their diabetes (26). In terms of difficulty in swallowing medications, our findings contrasted with a systematic review which listed difficulty swallowing medication as a factor of nonadherence. Other risk factors of nonadherence included frequent dosing, high number of prescribed medications, drug formulation and poor taste (27,28). The presence of comorbidities was another risk factor for medication nonadherence. Diabetes patients with comorbidities generally have multiple medications of different pharmacological classes such as antihypertensive, lipid-lowering agents, and antiplatelet. This complex treatment regimen could have contributed to nonadherence. However, our study found no association between the number of concurrent medications or comorbidities with medication nonadherence. A previous study in Johor also reported no association between the number of medications and medication nonadherence (8). Patients with numerous medications and complex treatment might have experienced more side effects, leading to decreased adherence (29). Hence, greater attention from healthcare professional was needed to prevent the risks of polypharmacy and increase adherence rate.

This study had several limitations. Firstly, self-reporting with guided interview was used for data collection in this study, which could have introduced biases related to social desirability and lead to recall bias. Secondly, it might be challenging to extrapolate the study's findings to other groups of patients because the study only included patients within a single health district.

Conclusion

Overall, this study found that the percentage of medication nonadherence among geriatric patients with diabetes mellitus in the Marang district health clinics was 53.4% with household income identified as the only significant factor associated with medication nonadherence. Identifying the possible factors of medication nonadherence can help pharmacists to implement strategies to enhance patients' medication adherence and improve their health outcomes.

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Conflict of Interest statement

The authors declare that there is no conflict of interest.

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