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Factors associated with medication adherence in diabetes patients during the COVID-19 pandemic

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ABSTRACT

Identifying the factors affecting diabetes medication adherence is an important step in establishing interventions to improve prescription compliance and help patients manage their disease effectively and successfully. A cross-sectional study of patients with type 2 diabetes (T2D) at Saint Paul Hospital, Hanoi, Vietnam, used a structured questionnaire. Of the 250 patients, 60% (150) were female. The median age was 67.5 years, and the median duration of diabetes was 9.6 years. The mean medication adherence report scale (MARS-5) score was 23.1±3.1. The mean fear of COVID-19 (FCoVID-19) score was 16.8±6.3. The mean self-efficacy for appropriate medication uses scale (SEAMS) score indicating the patient's confidence in taking medication correctly was 31.1±5.6. The mean medication literacy measure (MLM), which assesses the patient's knowledge of diabetes medications, was 8.3±4.9, with 27.2% of patients having high levels. The relationships between adherence to medication and comorbidities, knowledge about medication, and psychological effects of diabetes were statistically significant according to multivariable linear regression. The study showed that intervention programs that focus on factors affecting adherence can be effective at improving patient health outcomes.

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1. INTRODUCTION

Diabetes mellitus (DM) is a prevalent and substantial chronic metabolic disorder associated with many complications that can cause disability for patients, burdening families and society on both national and global scales, necessitating long-term pharmaceutical usage. Among the fundamental self-care behaviors for diabetic patients, medication adherence plays a pivotal role in effectively managing the disease [1], [2]. Despite the proven efficacy of diabetes pharmaceutical treatments, achieving their optimal effectiveness is hindered by a significant rate of medication nonadherence among diabetic patients, where approximately 50% do not adhere to their prescribed medications, as corroborated by previous studies [3]–[5]. Nonadherence to prescribing guidelines and lack of medication adherence measures were significantly associated with increased risk of hospitalization, longer hospital stays, and greater hospitalization costs [6], [7].

Diabetes medication nonadherence in patients has been associated with psychosocial determinants of treatment adherence, such as anxiety, diabetes distress, older age, poor communication with physicians, stress, concerns about medicines and cognitive impairment related to levels of self-care and medication adherence [8]. Self-efficacy, which pertains to the patient's confidence in appropriately using medication and understanding medication guidelines, is of paramount importance [9]. Nonadherence stemming from poor comprehension and the use of medication information poses a significant risk for uncontrolled disease and heightened susceptibility to diabetes complications, leading to prolonged hospital stays [10]. Consequently, it is imperative to evaluate patients' aptitude in comprehending medication information and their confidence in correctly adhering to medication regimens. Such assessments can shed light on the root causes of suboptimal diabetes control and facilitate the identification of solutions to enhance diabetes knowledge, medication compliance, and overall self-care behaviors among individuals with diabetes.

The COVID-19 pandemic has induced heightened levels of anxiety and concern among individuals, potentially leading to disruptions in the management of chronic conditions [11]. As a consequence of these psychological effects, individuals with chronic conditions, such as diabetes, may face challenges in achieving positive health outcomes and may exhibit reduced adherence to their prescribed treatment regimens [12]. However, further research is needed to comprehensively investigate the impact of the COVID-19 pandemic on diabetes care and to assess any alterations in adherence to diabetes medication during this period.

The measurement of medication adherence encompasses the assessment of individuals' behaviors toward medication use and their lifestyle practices. Regrettably, there is currently a lack of research in Vietnam examining medication noncompliance and its potential underlying causes among diabetes patients, particularly in the context of the COVID-19 pandemic. Therefore, our study aimed to investigate medication adherence, knowledge, and self-efficacy in medication usage, as well as the impact of fear on medication adherence in patients with type 2 diabetes mellitus (T2DM) during the COVID-19 pandemic, followed by recommendations to position health literacy scholars and practitioners to better meet communication challenges and provide consulting for patients during future crises.

2. METHOD

2.1. Study design and participants

A cross-sectional study was conducted on 250 patients diagnosed with type 2 diabetes and treated as outpatients using online-based survey questionnaires from September 1, 2021, to December 31, 2021, at Saint Paul Hospital, Hanoi, Vietnam. The patient had taken at least 1 hypoglycemic agent within the previous three months and agreed to participate in the study. Patients who were unable to communicate during the interview or who were pregnant or lactating were excluded from the study.

2.2. Data collection

A cohort comprising 250 eligible patients in accordance with the predefined criteria was invited to partake in the study. Information was collected through an online survey using a structured questionnaire and through the retrieval and analysis of medical records. Pertinent details encompassing patients' demographic profiles, medical backgrounds, and prescribed pharmaceutical regimens were recorded.

2.2.1. Assessment of adherence

The evaluation of medication adherence across the patient's entire prescribed regimen was conducted using the medication adherence report scale (MARS-5) [13], [14]. The MARS-5 instrument comprises 5 statements pertaining to the frequency of actions, such as medication omission, dose adjustments, missed doses, temporary cessation of medication, and deviation from prescribed dosage. Each query is accompanied by a five-point scale ranging from "1 point - always" to "5 points - never", resulting in a cumulative score ranging from 5 to 25. Elevated scores correspond to heightened adherence levels [15], [16].

2.2.2. Assessment of the understanding of the medication information and guidelines

Patient competence in comprehending and applying pharmaceutical information was assessed utilizing the medication literacy measure (MLM) tool [17], [18]. The MLM is an integrated assessment tool encompassing 17 items segmented into four sections: the initial part comprises five true/false queries concerning medical terminology comprehension; the subsequent sections (2-4) encompass multiple-choice inquiries encompassing over-the-counter drug labeling (5 questions), marketing of supplements (3 questions), and utilization of prescriptions (4 questions). Each accurate response is assigned 1 point, while incorrect or unidentified responses receive 0 points. The cumulative score ranges from 0 to 17. Proficiency in comprehending and applying pharmaceutical information is categorized into two levels: adept understanding and application (≥13 points) and inadequate understanding and application (<13 points) [19].

2.2.3. Assessment of the patient's self-assurance

The self-efficacy for appropriate medication use scale (SEAMS) comprises 13 inquiries aimed at assessing the level of confidence in correctly adhering to medication regimens across various contexts [20]. Each question offered three response options: "1 point - not confident", "2 points-slightly confident", and "3 points-very confident". The cumulative score ranged from 13 to 39 points, with elevated scores denoting a greater degree of patient confidence in their ability to adhere to medication instructions accurately [15], [20].

2.2.4. Assessment of the effect of the psychological factors of COVID-19 on medication adherence

The evaluation of the psychological impacts of COVID-19 on diabetes medication adherence was conducted through the utilization of the Fear of COVID-19 (FCoVID-19) questionnaire [21], [22]. This instrument comprises a set of seven inquiries, each furnished with five response options, where 1 corresponds to "strongly disagree", 2 to "disagree", 3 to "neutral", 4 to "agree", and 5 to "strongly agree". The cumulative score of these seven questions yields a composite value ranging from 7 to 35, with higher scores indicating heightened apprehension about COVID-19.

2.3. Statistical analysis

Data entry was performed using Microsoft Excel, and all the statistical analyses were conducted using SPSS version 25.0. Descriptive statistics were used to summarize categorical and binary variables in terms of frequencies. For continuous and discrete variables following a normal distribution, descriptive statistics are presented as the mean±standard deviation.

The reliability of the toolkit, as assessed through patient self-evaluation, was evaluated using Cronbach's alpha analysis and the variable-total correlation coefficient for each question. A Cronbach's alpha coefficient of ≥0.70 signifies satisfactory scale reliability. The variable-total correlation coefficient denotes the strength of association between individual questions and the overall toolkit. Variables with weak correlations with others would have lower variable-total correlation coefficients and may warrant removal. A common threshold for exclusion is <0.3, although when the toolkit includes 7 or more observed variables, a threshold of 0.4 or 0.5 might be considered to retain the best variables [23], [24].

Exploratory factor analysis (EFA) was employed to delineate the structure of the toolkit. Varimax rotation was used to analyze the factor structure and establish subgroups within the scale. Suitability for factor analysis was assessed using the Kaiser–Meyer–Olkin (KMO) coefficient, with values ≥0.5 (0.5≤KMO≤1) indicating adequate suitability for factor analysis. The Bartlett test was used to assess whether observed variables within the factor were correlated. A statistically significant difference according to Bartlett's test (sig Bartlett's test<0.05) indicated intercorrelation among the observed variables within the factor. The loading factor determined the correlation between the observed variables and factors. A loading factor of ±0.3 was the minimum threshold for retaining observed variables. Loading factors of ±0.5 and ±0.7 indicated good and very good statistical significance, respectively [25].

Linear regression was used to identify factors influencing medication adherence, with the medication adherence score as the dependent variable. Univariate regression was initially performed to assess the independent association between compliance scores and patient characteristics. Medication information comprehension and application were indicated both as a continuous competency score and a categorical competency classification (good/bad). Subsequently, multivariable linear regression analysis was executed using a backward selection approach, with all the independent variables initially included and then systematically eliminated if $p<0.1$. Age and sex were fixed as independent variables in the models. The selected model had the highest adjusted R-squared value. $p<0.05$ indicated statistical significance. The fitness of the multivariable linear regression model was assessed through the F test. A significance <0.05 indicated model suitability, while a significance >0.05 implied a lack of suitability. A t-test was used to assess the significance of the regression coefficient of each independent variable within the model. A significance <0.05 indicated an impact of the independent variable on the dependent variable, with a negative sign for the regression coefficient (Beta) indicating a negative effect. The magnitude of the impact of the independent variables on the dependent variable was gauged by the absolute value of the coefficient Beta; a larger absolute Beta signified a stronger influence.

2.4. Ethics

The research ethics of this research protocol were reviewed by the Saint Paul Hospital and the Hanoi University Pharmacy Review Board. A total of 727/QĐ-DHN were granted on September 30, 2021. The study strictly adhered to the established ethical principles guiding biomedical research. Written informed consent was procured from all study participants prior to their involvement

3. RESULTS AND DISCUSSION

In this study, we conducted a comprehensive assessment of medication adherence, self-efficacy for appropriate medication use, medication literacy, and fear of COVID-19 among outpatient type 2 diabetes patients at Saint Paul General Hospital during the COVID-19 pandemic. Our findings shed light on factors that could influence medication adherence in this specific patient population.

3.1. Patient demographic characteristics

A total of 250 participants were included in the study; 100 (40.0%) were male, and 150 (60.0%) were female. The participants' mean age was 67.5±7.9 years, 30.4% were younger than 65 years, 50.8% were aged 65-74 years, and 18.8% were aged 75 years or older. A total of 1.2% reported smoking. A total of 2.4% had an education level less than high school graduation, 50.8% were high-school graduates, and 46.8% had a college education or higher. The majority of participants (89.3%) were retired, with only a small percentage engaged in employment (8.4%). Regarding diabetes diagnosis, 19.2% had been diagnosed for less than 5 years, 48% had a diagnosis duration of 5-10 years, and 32.8% had been diagnosed for more than 10 years, with a mean duration of 9.5±5.9 years. Hypertension (69.2%), dyslipidemia (72%), and cardiovascular disease (13.6%) were notable. Hypoglycemia was rare (1.6%). The mean HbA1c level was 8.1±1.5%; 22.5% had an HbA1c level less than 7%, 32.4% had an HbA1c level of 7-7.9%, and 45.1% had an HbA1c level of 8% or higher. Fasting blood glucose levels were less than 7.2 mmol/l (37.5%). The mean LDL-C level was 3.1±0.7 mmol/L, with 84.3% having LDL-C levels ≥2.6 mmol/L. Among males, 62.5% had HDL-C levels above 1 mmol/L, while among females, 44.7% had HDL-C levels above 1.3 mmol/L. Triglyceride levels were mostly less than 1.7 mmol/L. The psychological factor diabetes had no effect on 85.2% of the patients, had little effect (9.6%), had some effect (4.4%), had a strong effect (0.8%), and had no significant effect (0%). Regarding prescription characteristics, the average patient has prescribed 4.7±1.4 medication, with prominent usage of biguanide (76.4%), sulfonylurea (49.6%), and insulin (37.2%), consistent with the results of a review of published literature since 2017, as detailed in Table 1. The highest rate of adherence and persistence was consistently observed in metformin users, followed by those in whom sodium–glucose cotransporter 2 inhibitors were used. Insulin and glucagon-like peptide-1 receptor agonists have low adherence and retention rates [26], [27]. The COVID-19 pandemic has not significantly affected patient access to medication supplies, the development of telehealth services or the use of online medication orders to restore medication adherence habits [28]. Additionally, the majority of patients in our study were prescribed a twice-daily medication regimen (65.6%). This can also influence the daily dose frequency on medication adherence, as previous research has consistently demonstrated that monotherapy tends to yield higher adherence rates than multimodal regimens [2], [29].

The comorbidities and medication adherence were as: 1.6±0.7 comorbidities on average, predominantly characterized by dyslipidemia (72.0%) and hypertension (69.2%). Comorbidities encompass diabetes-related complications and suboptimal glycemic control, along with instances of hypoglycemia, contributing to escalated health care resource utilization and associated costs in type 2 diabetes patients [30]. Notably, the presence of comorbidities introduces formidable challenges in medication management, thereby correlating with diminished medication adherence rates. This phenomenon can be attributed to the intricacies associated with multiple medication regimens, which often lead to confusion and overwhelming, thereby impeding patient adherence. Furthermore, comorbidities may induce physical or cognitive impairments that hinder patients from adhering to prescribed medication regimens [2], [29]. Furthermore, a subset of participants (4.8%) presented with diabetic complications, with retinal issues (3.2%) constituting the prevailing concern. This observation aligns with analogous global studies [30], [31]. The implications of these findings underscore the pivotal significance of early diabetes detection and effective management for preventing the onset of complications. Moreover, patient education initiatives emphasizing the value of routine ocular examinations and stringent blood sugar control have the potential to substantially enhance patients' quality of life and mitigate the healthcare costs correlated with diabetes-related complications [31]. According to the study findings, comorbidities, medication literacy, and psychological impacts are found to be statistically significant factors influencing medical adherence.

3.2. Medication adherence behaviors and scores

The mean medication compliance score was 23.1±3.1. Among the assessed medication adherence behaviors, "forgetting to take medication" was the most prevalent, with 0.4% of participants "always" forgetting and 2.4% "frequently" forgetting. Forgetting "sometimes" was reported (13.2%), while 21.6% of respondents reported "seldom" forgetting. The majority of participants (62.4%) consistently affirmed "never" forgetting their medication. In contrast, "temporary stopping medication" had the highest adherence, as 86.8% steadfastly reported "never" temporarily discontinued their medication. None of the participants admitted to "always" stopping medication, while a marginal 0.4% indicated "frequent" cessation, 4.4% "sometimes" halting, and 8.4% "seldom" interruptions. Regarding other adherence behaviors, 26.4%

"changing the prescribed dose," while 23.2% admitted to taking their medication less than prescribed. A total of 23.6% of the participants reported “missing out a dose”, as detailed in Table 2.

Table 1. Characteristics of the study population (n=250)

	Characteristic	Overall n=250 (100%)	Male n=100 (40.0%)	Female n=150 (60.0%)
Age (years)	<65	76 (30.4%)	46 (46%)	44 (29.3%)
	65-74	127 (50.8%)	42 (42%)	80 (53.3%)
	≥75	47 (18.8%)	12 (12%)	26 (17.4%)
	Mean ± SD	67.5±7.9	66.4±8.0	68.3±7.7
Race, n (%)	Kinh	250 (100%)	100 (100%)	150 (100%)
	Other	0 (0%)	0 (0%)	0 (0%)
Accommodation	Urban	250 (100%)	100 (100%)	150 (100%)
	Countryside	0 (0%)	0 (0%)	0 (0%)
Health insurance	Yes	250 (100%)	100 (100%)	150(100%)
	No	0 (0%)	0 (0%)	0 (0%)
Smoke	Yes	3 (1.2%)	3 (3%)	0 (0%)
	No	247 (98.8%)	97 (97%)	159 (100%)
Education	Under high-school graduate	6 (2.4%)	3 (3%)	3 (2%)
	High-school graduate	127 (50.8%)	47 (47%)	80 (53.3%)
	Some college or technical school/College graduate	117 (46.8%)	50 (50%)	67 (44.7%)
Employment, n (%)	Employment, n (%)	21 (8.4%)	11 (11%)	10 (6.7%)
	Self-employed/work from home	1 (0.4%)	1 (1%)	0 (0%)
	Retired	223 (89.3%)	86 (86%)	137 (91.3%)
	Unemployed	5 (2%)	2 (2%)	3 (2%)
Marital status, n (%)	Single/never married	4 (1.6%)	1 (1%)	3 (2%)
	Married	241 (96.4%)	98 (98%)	143 (95.3%)
	Separated/Divorced/Widowed	5 (2%)	1(1%)	4 (2.7%)
Duration of diabetes diagnosed (years)	<5 years	48 (19.2%)	33 (33%)	15 (10%)
	5-10 years	120 (48%)	39 (39%)	81 (54%)
	>10 years	82 (32.8%)	28 (28%)	54 (36%)
	Mean±SD	9.5±5.9	9.0±5.8	10.1±5.6
Complications of diabetes	Complications on cardiovascular	1 (1.2%)	1 (1%)	0 (0%)
	Neurological complications	1 (0.4%)	0 (0%)	1 (0.6%)
	Retinal complications	8 (3.2%)	2 (2%)	6 (4%)
	Complications of the foot	2 (0.8%)	0 (0%)	2 (1.3%)
Comorbidities	No	17 (6.8%)	7 (7%)	9 (6%)
	Hypertension	173 (69.2%)	65 (65%)	108 (72%)
	Dyslipidemia	180 (72%)	70 (70%)	110 (73.3%)
	Digestive disorders	1 (0.4%)	0 (0%)	1 (0.6%)
	Osteoarthritis	3 (1.2%)	0 (0%)	3 (2%)
	Cardiovascular disease	34 (13.6%)	15 (15%)	19 (12.7%)
	Other	18 (7.2%)	10 (10%)	8 (5.3%)
	Mean ± SD	1.6±0.7	1.5±0.8	1.4±0.6
Hypoglycemia	Yes	4 (1.6%)	3 (3%)	1 (0.6%)
	No	246 (98.4%)	97 (97%)	149 (99.3%)
HbA1C (%), (N=213)	Mean± SD	8.1±1.5	8.2±1.6	8.1±1.4
	<7	48 (22.5%)	23 (23%)	25 (16.7%)
	7-7.9	69 (32.4%)	25 (25%)	44 (29.3%)
	≥8	96 (45.1%)	52 (52%)	44 (29.3%)
Fasting blood glucose (mmol/l) (N=240)	<7.2 mmol/l	90 (37.5%)	41 (41%)	49 (32.7%)
LDL-C (mmol/l), (N=70)	Mean ± SD	3.1 ± 0.7	3.0 ± 0.8	3.2 ± 0.8
	<1.8	4 (5.7%)	3 (3%)	1 (1%)
	1.8-2.5	7 (10%)	5 (5%)	2 (2%)
	≥2.6	59 (84.3%)	23 (23%)	36 (24%)
HDL-C	Males>1 mmol/l (N=24)		15 (62.5%)	
	Females>1.3 mmol/l (N=38)			17 (44.7%)
Triglycerides (mmol/l), (N=228)	Males <1.7 mmol/l (N=94)	91 (40%)	45(47.8%)	
	Females<1.7 mmol/l (N=134)			46 (34.3%)
Frequency of medication use	Number of medication in prescription (Mean±SD)	4.7±1.4	4.4±1.2	4.7±1.4
	Prescription with blood pressure medication	173 (69.2%)	74 (74%)	99 (66.0%)
	Prescription with metformin	191 (76.4%)	89 (89%)	102 (68%)
	Prescription with sulfonylurea	124 (49.6%)	53 (53%)	71 (47.3%)
	Prescription with insulin	93 (37.2%)	39 (39%)	54 (36%)
	Prescriptions with combination hypoglycemic medication	23 (9.6%)	8 (8%)	15 (10%)
	The patient uses additional supplements in addition to the medicine prescribed by the doctor	40 (16.0%)	17 (17%)	23 (15.3%)
Psychological effects of diabetes	No effect	213 (85.2%)	84 (84%)	129 (86%)
	Little effect	24 (9.6%)	9 (9%)	15 (10%)
	Some effect	11 (4.4%)	6 (6%)	5 (3.3%)
	Strong effect	2 (0.8%)	1 (1%)	1 (1%)
	Significant effect	0 (0%)	0 (0%)	0 (0%)

Note: N=number; SD=standard deviation

Table 2. Assessment of medication adherence in patients with diabetes based on the MARS-5 scale

Question	Patient self-assessment score, number of patients (%)				
	Always (1 point)	Frequent (2 point)	Sometimes (3 point)	Seldom (4 point)	Never (5 point)
1. I forget to take it	1 (0.4)	6 (2.4)	33 (13.2)	54 (21.6)	156 (62.4)
2. I changed the dose	0.0	7 (2.8)	31 (12.4)	28 (11.2)	184 (73.6)
3. I take less than prescribed	0.0	10 (4.0)	20 (8.0)	28 (11.2)	192 (76.8)
4. I miss out on a dose	0.0	4 (1.6)	23 (9.2)	32 (12.8)	191 (76.4)
5. I stop taking it for a while	0.0	1 (0.4)	11 (4.4)	21 (8.4)	217 (86.8)
Medication compliance score (Mean±SD)			23.1±3.1		

Assessment of medication adherence, self-efficacy for appropriate medication use, medication literacy, and fear of COVID-19 among outpatient type 2 diabetes patients during the COVID-19 pandemic. Our findings shed light on factors that could influence medication adherence in this specific patient population. There was a comparable level of medication adherence, with patients consistently responding "never" across various medication-taking behaviors, resulting in a robust average medication compliance score of 23.1±3 on the MARS-5. This outcome underscores the patients' strong commitment to adhering to their prescribed medication regimens. Lee's study on oral medication adherence among patients with type 2 diabetes mellitus treated with polytherapy in a developed Asian community also showed a high median MARS-5 score of 24 [14]. In contrast, a study by Yosef *et al*. [26] reported notably lower medication adherence rates (29.4%) among diabetes patients in Eastern Ethiopia. Specifically, in their study, merely 12.6% of the patient cohort exhibited a persistent absence of forgetfulness in adhering to their prescribed medication regimen. Furthermore, a substantial 19.2% of the participants consistently refrained from temporarily discontinuing their medication intake, demonstrating remarkable continuity in their treatment. A notable 16.3% upheld an unwavering commitment to never omit any of their prescribed medications. Additionally, 31.8% of the patients rigorously adhered to the prescribed dosage without any deviation, demonstrating their remarkable consistency. Notably, 12.2% of patients exhibited steadfast adherence to the prescribed dosage regimen, signifying their unwavering commitment to medication adherence. This reflects the potential variations in adherence patterns among different populations.

3.3. Assessment of patient confidence in medication management

Table 3 shows that the calculated mean confidence score for the ability to manage medications correctly was 31.1±5.6. This score provides insights into the average level of confidence among patients in effectively adhering to their medication regimen across various scenarios.

3.3.1. Factor 1: situational challenges

When facing a busy day, only 1.6% were "not confident", 27.2% were "somewhat confident", and 71.2% were "very confident". When the medication schedule was inconvenient, 1.2% lacked confidence, 20.8% felt somewhat confident, and 54.0% were very confident. When away from home, 1.6% were not confident, 32.8% were somewhat confident, and 65.5% were very confident. However, when the normal routine was disrupted, 25.2% lacked confidence, 20.8% were somewhat confident, and 54.0% were very confident. Among those taking medicines multiple times a day, 4.0% were not confident, 18.8% were somewhat confident, and 77.2% were very confident. When feeling sick, 3.2% were not confident, 24.8% were somewhat confident, and 72.0% were very confident.

3.3.2. Factor 2: complexity and uncertainty

When taking several different medicines daily, 10.4% lacked confidence, 25.6% felt somewhat confident, and 64.0% were very confident. When unsure about the timing of medication, 12.4% were not confident, 24.0% were somewhat confident, and 63.6% were very confident. When unsure about how to take the medicine, 10.8% lacked confidence, 31.2% were somewhat confident, and 58.0% were very confident. Additionally, when nobody reminded them to take their medication, 2.0% were not confident, 28.8% were somewhat confident, and 69.2% were very confident.

3.3.3. Factor 3: medication changes and side effects

When a doctor altered their medicine, 52.8% expressed a lack of confidence, 22.0% felt somewhat confident, and 25.2% were very confident. Similarly, when receiving a refill with pills that looked different, 52.8% were not confident, 24.8% were somewhat confident, and 22.4% were very confident. Finally, when medications caused side effects, 53.6% lacked confidence, 20.8% felt somewhat confident, and 25.6% were very confident.

Table 3. Assessment of confidence in a patient's ability to take medication correctly based on the self-efficacy for appropriate medication use scale

Factor	Question	Patient self-assessment score, number of patients (%)		
		Not confident (1 point)	Somewhat confident (2 point)	Very confident (3 point)
Factor 1	2. When you have a busy day planned?	4 (1.6)	68 (27.2)	178 (71.2)
	6. When the schedule to take the medicine is not convenient?	3 (1.2)	52 (20.8)	135 (54.0)
	3. When you are away from home?	4 (1.6)	82 (32.8)	164 (65.5)
	7. When your normal routine gets messed up?	63 (25.2)	52 (20.8)	135 (54.0)
	5. When you take medicines more than once a day?	10 (4.0)	47 (18.8)	193 (77.2)
	13. When you are feeling sick (like having a cold or the flu)?	8 (3.2)	62 (24.8)	180 (72.0)
Factor 2	1. When you take several different medicines each day?	26 (10.4)	64 (25.6)	160 (64.0)
	10. When you are not sure what time of the day to take your medicine?	31 (12.4)	60 (24.0)	159 (63.6)
	9. When you are not sure how to take the medicine?	27 (10.8)	78 (31.2)	145 (58.0)
	4. When no one reminds you to take the medicine?	5 (2.0)	72 (28.8)	173 (69.2)
Factor 3	11. When a doctor changes your medicines?	132 (52.8)	55 (22.0)	63 (25.2)
	8. When you get a refill of your old medicines and some of the pills look different than usual?	132 (52.8)	62 (24.8)	56 (22.4)
	12. When they cause some side effects?	134 (53.6)	52 (20.8)	64 (25.6)
Score of confidence in ability to take medication correctly (Mean±SD)			31.1±5.6	

The patients' mean SEAMS scores were quite high (31.1 out of 39). This outcome underscores the considerable confidence our patients possess regarding their capacity to appropriately administer medications. This substantial level of confidence is corroborated by comparable findings in preceding studies. For instance, Huang *et al.* [32] investigation of diabetic patients in the United States reported patients' confidence scores pertaining to the accurate administration of medications, ranging from 13 to 39 points, with a mean confidence score of 33.2±6.0. This heightened self-assuredness in correctly managing medication regimens correlates positively with improved medication adherence. Patients who exude confidence in their ability to administer medications accurately are more inclined to adhere to prescribed dosages and schedules, consequently contributing to enhanced overall health outcomes.

3.4. Assessment of patient medication literacy

The mean score for the ability to understand and apply medication-related information was 8.3±4.9. Among the participants, 27.2% demonstrated good ability, scoring ≥13 points, while 72.8% exhibited poor ability, scoring <13 points. To understand and apply medication-related information, see Table 4.

3.4.1. Factor 1: understanding medication information

Patients were assessed for their understanding of basic medication-related terms and concepts. When questioned about side effects, 40.4% of the patients gave incorrect responses. Regarding the accuracy of the information sources, 36.4% of the respondents answered incorrectly. When asked about whether the time of use was stated in the application, 32.0% of the participants responded incorrectly. Finally, when asked about the term "external drug", 28.4% of the respondents gave incorrect responses, while 71.6% answered correctly.

3.4.2. Factor 2: medication terminology

Patients' familiarity with specific medication-related terminology was evaluated. For terms such as "fixed-dose combination drug", 78.8% of the patients answered incorrectly. Regarding warnings on leaflets, 69.6% answered incorrectly. When assessing the recognition of incorrect medication strength dispensing, 71.2% provided incorrect responses. Similarly, for the term "dosage", 58.4% answered incorrectly, while 41.6% answered correctly.

3.4.3. Factor 3: medication details

Patients' knowledge of specific medication details was examined. For indicating the expiration date on the box, 66.8% answered incorrectly. When asked about the number of pills listed on the box, 62.0% of the respondents responded incorrectly. Regarding dosage indications on labels, 57.6% answered incorrectly. For the term "ingredient", 54.8% of the patients responded incorrectly. When inquired about indications for dietary supplements, 35.2% answered incorrectly.

3.4.4. Factor 4: medication usage

Patients were asked to focus on their understanding of medication usage. Recognizing and treating signs of hypoglycemia per the instructions, 61.6% of the patients answered incorrectly. "Side effects", 41.2% responded incorrectly. Regarding indications on the label, 34.8% answered incorrectly. Regarding the number of days of prescribed use, 46.0% of the respondents answered incorrectly.

Table 4. Assessing the ability to understand and apply medication information in patients with type 2 diabetes based on the medication literacy measure scale

Factor	Question	Answer (%)	
		Wrong, (1 point)	Correct, (1 point)
Factor 1	13. Side effects	101 (40.4)	149 (59.6)
	12. Accuracy of information source	91 (36.4)	159 (63.6)
	14. The time of use is stated in the application	80 (32.0)	170 (68.0)
	1. The term "external drug"	71 (28.4)	179 (71.6)
Factor 2	5. The term "fixed-dose combination drug"	197 (78.8)	53 (21.2)
	10. Warning on the leaflet	174 (69.6)	76 (30.4)
	17. Recognizing that the medication is dispensed in the wrong strength	178 (71.2)	72 (28.2)
	2. The term "dosage"	146 (58.4)	104 (41.6)
Factor 3	9. Expiry date is indicated on the box	167 (66.8)	83 (33.2)
	8. The number of pills is listed on the box	155 (62.0)	95 (38.0)
	7. Dosage is indicated on the label	144 (57.6)	106 (42.4)
	4. The term "ingredient"	137 (54.8)	113 (45.2)
	11. Indications of dietary supplements	88 (35.2)	162 (64.8)
Factor 4	16. Recognize and treat signs of hypoglycemia according to instructions in the application	154 (61.6)	96 (38.4)
	3. The term "side effects"	103 (41.2)	147 (58.8)
	6. Indications are indicated on the label	87 (34.8)	163 (65.2)
	15. Number of days of use prescribed	115 (46.0)	135 (54.0)
Score of ability to understand and apply medication information, (Mean±SD)		8.3±4.9	
Patients with good ability to understand and apply information (≥13 points)		68 (27.2%)	
Patients with poor ability to understand and apply information (<13 points)		182 (2.8%)	

Patients exhibited a relatively modest ability to comprehend and apply medication-related information, with an average total score of 8.3 (out of 17) on the MLM tool. These findings underscore the imperative necessity of improving patients' capacity to interpret and employ medication-related information, ultimately fostering improved medication adherence. Our study aligns with prior research [33]–[35] indicating a significant correlation between medication literacy and adherence, wherein individuals exhibiting greater proficiency in comprehending and implementing medication-related information tend to demonstrate superior adherence to prescribed regimens. This association has also been observed in patient populations with conditions such as coronary artery disease and hypertension [36], [37]. Capacity-building measures may include refining patients' comprehension and practical ability to navigate frequently encountered medication information sources, encompassing prescription documents, medication packaging materials, and patient-oriented medication information pamphlets [17], [18], [38].

3.5. Factor analysis of patient fear of COVID-19

The mean fear assessment score across all participants was 16.8±6.3, reflecting the participants' collective feelings regarding fear related to COVID-19. The analysis of COVID-19 fear assessment yielded two distinct factors, factor 1 and factor 2. Each factor exhibited varying degrees of agreement with statements that encompassed a spectrum of emotions concerning COVID-19, see Table 5.

3.5.1. Factor 1: psychological impact of COVID-19

Encompassed questions that explored the psychological implications of COVID-19 for the participants. The survey responses were distributed as follows: "I am most afraid of COVID-19"; 20.8% strongly disagreed, while 18.0% strongly agreed; similarly, "I am afraid of losing my life because of COVID-19"; 22.0% strongly disagreed, while 18.0% strongly agreed. "When watching news and stories about COVID-19 on social media, I become nervous or anxious," 23.2% strongly disagreed, whereas 12.4% strongly agreed. Finally, 27.6% strongly disagreed that "it makes me uncomfortable to think about COVID-19", whereas 8.8% strongly agreed.

Table 5. Assessment of COVID-19 fear among patients with type 2 diabetes based on the COVID-19 fear assessment scale

Factor	Question	Patient self-assessment score, Number of patients (%)				
		1	2	3	4	5
Factor 1	1. I am most afraid of COVID-19.	52 (20.8)	65 (26.0)	52 (20.8)	36 (14.4)	45 (18.0)
	4. I am afraid of losing my life because of COVID-19.	55 (22.0)	55 (22.0)	56 (22.4)	39 (15.6)	45 (18.0)
	5. When watching news and stories about COVID-19 on social media, I become nervous or anxious.	58 (23.2)	72 (28.8)	61 (24.4)	28 (11.2)	31 (12.4)
	2. It makes me uncomfortable to think about COVID-19.	69 (27.6)	68 (27.2)	63 (25.2)	28 (11.2)	22 (8.8)
Factor 2	6. I cannot sleep because I'm worrying about getting COVID-19.	89 (35.6)	107 (42.3)	54 (21.6)	0.0	0.0
	7. My heart races or palpitates when I think about getting COVID-19.	85 (34.0)	114 (45.6)	51 (20.4)	0.0	0.0
	3. My hands become clammy when I think about COVID-19.	75 (30.0)	68 (27.2)	78 (31.2)	14 (5.6)	15 (6.0)
Fear assessment score (Mean±SD)				16.8±6.3		

Note: 1=strongly disagree (1 point); 2=disagree (2 point): 3=neither agree or disagree (3 point); 4=agree (4 point); 5=strongly agree (5 point)

3.5.2. Factor 2: physiological impact of COVID-19

Factor 2 pertained to the physiological impact of COVID-19 on the participants. Responses to these questions indicated varying degrees of concern and physiological reactions. Notably, a significant percentage of respondents indicated agreement with these statements, with responses such as "I cannot sleep because I'm worrying about getting COVID-19" having 35.6% strongly disagree and 42.3% disagree, while "My heart races or palpitates when I think about getting COVID-19" had 34.0% strongly disagree and 45.6% disagree.

3.6. Analysis of factors affecting medication adherence in patients with type 2 diabetes

Table 6 presents the results of a comprehensive analysis examining the factors influencing medication adherence in patients with type 2 diabetes. Notably, patients with comorbidities demonstrated a greater likelihood of adhering to their medication regimens, as demonstrated in the multiple model (B=1.145, p=0.039), indicating the importance of addressing multiple health conditions in diabetes management. Furthermore, individuals with greater medication literacy exhibited improved adherence according to the multiple model (B=0.204, p=0.029), emphasizing the significance of patient education in promoting proper medication use. Intriguingly, patients who reported a "strong effect" of psychological impacts related to diabetes had poorer adherence, as indicated in the simple model (B=-5.566, p=0.012), highlighting the critical role of psychological support in diabetes care. Other factors, including age, sex, and metabolic parameters, did not significantly influence adherence.

Table 6. Results of univariate analysis of factors affecting medication adherence

Variables	MARS-5					
	Simple model			Multiple model		
	B	P	B (95%CI)	B	P	B (95%CI)
Age (yrs)	0.006	0.807	-0.044–0.056	0.066	0.241	-0.45–0.177
Gender (male vs female)	0.180	0.657	-0.616–0.976	0.731	0.399	-0.992–2.453
Duration of diabetes diagnosed (years)	-0.009	0.785	-0.078–0.059	0.084	0.327	-0.086–0.255
Complications of diabetes	-0.449	0.552	-1.935–1.037	-1.506	0.189	-3.775–0.764
Comorbidities	0.274	0.307	-0.253–0.800	1.145	0.039	0.057–2.233
Hypoglycemia (yes vs no)	1.217	0.441	-1.889–4.324			
Taking more over-the-counter drugs (yes vs no)	-0.122	0.823	-1.198–0.953			
COVID-19 Score	-0.052	0.101	-0.113–0.010	0.027	0.683	-0.106–0,161
Psychological effects of diabetes						
No effect	Reference					
Little effect	0.643	0.336	-0.670–1.955			
Some effect	-0.702	0.464	-2.587–1.183			
Strong effect	-5.566	0.012	-9.897–(-1.234)			
Significant effect						
HbA1C	-0.125	0.392	-0.412–0.162			
Fasting blood glucose	-0.031	0.633	-0.159–0.097			
LDL-C	-0.085	0.866	-1.085–0.915			
HDL-C	0.749	0.519	-1.559–3.058	2.514	0.062	-0.134–5.162
Triglyceride	-0.033	0.084	-0.256–0.190			
Cholesterol	0.025	0.595	-0.067–0.116			
The self-efficacy for appropriate medication use scale score	-0.022	0.532	-0.092–0.047			
Medication literacy measure score	0.060	0.139	-0.020–0.141	0.204	0.029	0.021–0.387
Employment						
Employment	Reference					
Unemployed	0.829	0.596	-2.242–3.899			
Self-employed/work from home	-2.571	0.423	-8.887–3.744			
Retired	-0.589	0.411	-1.988–0.819			
Education						
High school graduate	Reference					
Under high school graduate	0.126	0.923	-2.453–2.705			
Some college or technical school/college graduate	0.374	0.353	-0.417–1.165			
Marital status						
Married	Reference					
Single/never married	0.429	0.786	-2.682–3.541			
Separated/divorced/widowed	-1.271	0.370	-4.059–1.518			
Smoke (yes vs no)	1.972	0.279	-1.604–5.547	4.027	0.101	-0.813–8.867
Number of medication in prescription	0.032	0.824	-0.247–0.310			
Number of antihypertensive medication in prescription	-0.047	0.884	-0.678–0.585			
Prescription with insulin (yes vs no)	0.598	0.168	-0.254–1.450			

The patient cohort exhibited heightened levels of fear associated with COVID-19 (FCoVID-19), registering an average FCoVID-19 score of 16.8±6.3. This psychological distress was found to exert a discernible influence on patients' adherence to prescribed medications, consistent with the findings of the study conducted by Gritsenko *et al*. in Belarus [39], which reported a comparable FCoVID-19 score of 16.6. However, it is noteworthy that our observed FCoVID-19 score was lower than that reported in studies conducted in Saudi Arabia (19.6±7.3) [40], Turkey (19.4) [41], and Japan (18.7) [42]. These disparities in FCoVID-19 scores across different countries likely stemmed from variations in cultural norms, socioeconomic contexts, and disparities in healthcare infrastructure and pandemic preparedness. Collectively, our study underscores the imperative of addressing not only the physical aspects of diabetes management but also the psychological well-being of patients, recognizing its substantial influence on medication adherence. Future research should explore multifaceted interventions aimed at ameliorating both psychological health and medication adherence among individuals with type 2 diabetes, particularly within the unique context of the COVID-19 pandemic and future pandemics.

This study has several limitations that should be considered. As information was mostly gathered via questionnaires and participant self-reports, it was subject to response bias and social desirability, which might have led to an understanding of the level of medical nonadherence among diabetes patients. Moreover, medication adherence evaluation might be difficult since there is no single metric that can be adopted as the criterion [14]. Finally, the study was limited by the use of a single healthcare facility and a limited sample size, which limits the generalizability of the findings to other settings and populations.

4. CONCLUSION

This study provided valuable insight into medical adherence among Vietnamese diabetes patients during the COVID-19 pandemic. This research also studied patients' mental health and fear of the COVID-19 pandemic and their knowledge and confidence in taking medication and identified potential factors affecting medication adherence. The findings of this study can help healthcare providers in Vietnam develop effective interventions to improve medication adherence and mental health support for diabetes patients during the pandemic. This research also highlights the importance of addressing patient education and confidence in medication management to ensure optimal health outcomes.

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