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ORIGINAL RESEARCH

Health Literacy and Medication Adherence Among Patients with Type 2 Diabetes in Jordan: A Cross-Sectional Study

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Background: Improving health literacy has been found to play a significant role in enhancing medication adherence in patients with type 2 diabetes.

Purpose: The present study aims to evaluate health literacy and its association with medication adherence among diabetic patients in Jordan.

Patients and Methods: This cross-sectional study included 400 diabetic patients, predominantly female (68.8%), with a median age of 58 years, attending the endocrinology outpatient clinic at Albasheer Hospital in Amman, Jordan, between August and December 2023. Patients were recruited using convenience sampling, including those aged 18 and older, literate, diagnosed with T2DM for at least one year, and on at least one medication for T2DM. Sample size was calculated based on the Events Per Variable (EPV) criterion to ensure sufficient power for logistic regression analysis. Data were collected using two validated instruments: the Jordanian Diabetic Health Literacy Questionnaire (JDHLQ), assessing health literacy, and the Medication Adherence Report Scale (MARS-5), measuring medication adherence. A binary logistic regression model was constructed to identify variables associated with adherence levels.

Results: The study enrolled 400 diabetic patients (females =68.8%). While most of the participants (70.3%) reported high adherence levels, results revealed a window for health literacy improvement as the median for the JDHLQ score was 22 (ranging from 18 to 25) out of a maximum possible score of 32. More than half of the participants replied "never" to "I forget to take my medications", followed by "I stop taking my medications for a while".

Conclusion: The binary regression model revealed that a higher JDHLQ score significantly increased the odds of a high adherence level. The significant association between improved health literacy and medication adherence necessitates the implementation of educational campaigns for enhancing literacy and hence medication adherence among patients with type 2 diabetes.

Keywords: health literacy, adherence, Jordanian, diabetes mellitus, MARS-5

Introduction

The prevalence of diabetes in Jordan has sharply increased in the past three decades. The prevalence of type 2 diabetes mellitus (T2DM) rose to 16% in 2020 and is expected to reach 21% by 2050,[1] making Jordan one of the highest countries in the prevalence of T2DM, not only regionally but also globally. Moreover, a recent study found that more than half (58%) of Jordan patients with T2DM had poor glycemic control.[2] Medication adherence, which is defined as "the degree to which the person's behavior corresponds with the agreed recommendations from a health care provider",[3] has been shown to contribute to improved glycemic control and enhance health outcomes among patients with type 2 diabetes mellitus (T2DM).[4] Nevertheless, it has been estimated that 25% of patients with chronic disease are considered non-adherent to disease

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prevention and management practices, including taking medication, dietary changes, exercise, and appointment-keeping.[5] Adherence rates among patients with chronic conditions, including cardiovascular and diabetes, vary between 50% and 60%,[6–8] despite the benefits of the drugs and the fact that these may have good health insurance that covers the medication cost.[9] Moreover, patients' non-adherence is attributable to numerous factors, including a lack of understanding of their disease and its treatments, their beliefs about the effectiveness of the prescribed treatment, demanding treatment regimens, a lack of social support, depression, and perceived barriers, including financial limitations and drug-related side effects.[10]

Medication adherence issues extend beyond diabetes, affecting various chronic conditions globally. For example, recent studies in cardiovascular medicine have pointed out that despite significant advancements in treatments, sticking to prescribed medication schedules continues to be a major hurdle in achieving optimal health outcomes. Effective strategies such as patient education and the simplification of medication regimes have been explored to tackle these issues.[11] In a similar vein, a study conducted in Saudi Arabia on hypertension patients showed a low adherence rate, with only 42% consistently taking their medication. This study further highlighted that a better understanding of their condition leads to improved adherence among patients.[12] These examples demonstrate the widespread nature of the adherence challenge, underlining the importance of addressing both patient education and systemic barriers to enhance treatment efficacy across different health conditions and regions.

Health literacy is defined as the

> Degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions.[13]

Earlier studies revealed that medication literacy is an important factor affecting medication adherence.[14] Patients with higher levels of health literacy have shown rates of medication adherence that are 14% higher than those of patients with lower levels of health literacy.[10]

The relationship between health literacy and medication adherence among diabetic patients in Jordan remains unexplored, presenting a significant gap in the existing literature. Given the impact of health literacy on medication adherence, as evidenced in various international contexts, understanding this dynamic within the Jordanian population could provide important insights for improving treatment outcomes. Therefore, the present study aimed to investigate the relationship between health literacy and medication adherence among Jordanians with T2DM, seeking to contribute findings that could guide patient education and public health policies.

Materials and Methods

Sample Size Calculation

Binary logistic regression was applied to identify the variables' association with adherence level. The rule of Events Per Variable criterion (EPV) ≥10 was utilized to estimate the minimal required sample size.[15] Since the regression model included 11 independent variables, the minimum sample size of 110 in the smaller of the two outcome groups is required. Thus, 119 patients in the smaller group were sufficient.

Procedure

Out of 442 T2DM patients who were invited to participate in the study, a total of 400 agreed to participate and completed the questionnaire, representing a response rate of 90.5%. Patients were attending the Albasheer Hospital endocrinology outpatient clinic located in Amman, the capital city of Jordan, between August 2023 and December 2023. Patients who were 18 years or older, literate, had a confirmed diagnosis with T2DM for a minimum of one year, and were taking at least one medication for T2DM were eligible to participate in the study. Patients with cognitive impairment were excluded from the study. The research assistant approached the eligible patients during their waiting time in a separate room at the outpatient clinic. The researcher emphasized on the voluntary nature of the study and the ability to withdraw at any time without any potential consequences. The researcher also emphasized on the anonymity and confidentiality of the collected data, written informed consent was obtained from the participants. The study followed the Declaration of

Helsinki's ethical guidelines. Ethical approval for the study was granted on May 1, 2023, by the Al-Zaytoonah University of Jordan (Ref#18/09/2022–2023).

Data Collection and Study Instruments

The first part of the collected sociodemographic data including gender, age, marital status, monthly income, and educational level. HbA1c values, determined on the day of the visit, along with information about the patient's treatment were collected from patients' medical records.

The next part included the Jordanian Diabetic Health Literacy Questionnaire (JDHLQ).[16] Its first section focuses on the informative aspect of health literacy, assessing patients' ability to evaluate, understand, and utilize information about T2DM. The second section concentrates on the communicative aspects of health literacy, evaluating patients' capability to effectively communicate about their disease. This includes, for example, their ability to explain the diabetic diet rationale, explain their condition to healthcare practitioners, and effectively ask healthcare professionals questions about their disease. These two sections are composed of eight questions each, with responses measured using a four-point Likert scale; a maximum score of 32 can be attained, where a higher total score represents a better ability. The JDHLQ demonstrated high validity and reliability with factor loadings above 0.5 and Cronbach's alpha above 0.8. The Rasch analysis indicated that the JDHLQ had acceptable item separation and person reliabilities for the two domains (0.855, 0.804 and 0.798, 0.731, respectively) and acceptable infit and outfit MSQ values with ordered thresholds.[16]

The third part of the questionnaire consisted of the validated Arabic version of the Medication Adherence Report Scale questionnaire (MARS-5),[17] a self-report measure used to assess patients' medication adherence. The MARS-5 has been extensively used in prior research on a variety of chronic illnesses, including hypertension, T2DM, and chronic obstructive pulmonary disease [20]. The MARS-5 contains five items: "I forget to take them", "I change the dose", "I stop taking them for a while", "I decide to skip a dose", and "I take medications less than instructed". The response options for each item are "always", "often", "sometimes", "rarely" and "never". The scores range from one point for "always" to five points for "never". The total attainable score ranges from 5 to 25 points. The adherence cutoff point of the current study was set to be 80% of the aggregated MARS-5 scores for the target population (ie, 20 out of 25). This cutoff point was determined based on previous literature[8,17–20].

Statistical Analysis

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS), version 26.0. Categorical variables were presented using percentages and frequencies, while continuous variables were described using the median and the 25th to 75th percentiles. The reliability of the MARS-5 scale was assessed using Cronbach's alpha with acceptable values being defined as greater than 0.7. Binary logistic regression was performed to assess the association of the predictors (age, marital status, education level, income and insurance status, JDHLQ score, dispensed medications) with adherence level. VIF was computed to assess multicollinearity and variables with VIF above 3 were excluded from the analysis, as well as predictors with percentages of <5%. Significance was set at a threshold of $p < 0.05$.

Results

Participants' sociodemographic profiles are shown in Table 1. The median age was 58 years (ranging from 50 to 64). Most participants were female (68.8%), had completed elementary school only (42.5%), were married (89.2%), earned less than 500 Jordanian Dinars (JD) monthly (81.2%), and had health insurance (79.0%). The median for the JDHLQ score was 22 (ranging from 18 to 25) out of a maximum achievable score of 32. The most used antidiabetic drug was metformin (86.7%) followed by insulin (37.7%) while thiazolidinediones were found to be the least used antidiabetic drugs (1.8%).

Participants' responses to MARS-5 items are displayed in Table 2. Most participants responded "never" to all five items on the scale. The item "I forget to take them" received the highest frequency of "never" responses at 51.6%, followed by "I stop taking them for a while" at 47%. The item with the lowest frequency of "never" responses was "I change the dose", at 44.1%. The median score for all items was 4, except for the item "I forget to take them", which had a median of 5. Therefore, this item represents the least common reason for nonadherence among participants. A remarkable 281 patients (70.3%) scored 20 or

Table 1 Sociodemographic Characteristics of Diabetic Patients

		Median (percentile 25-75)	Count (%)
Age		**58 (50–64)**	
HbA1c		**8.00 (6.80–10.00)**	
Gender	Female		275 (68.8%)
	Male		125 (31.3%)
Education	Elementary		169 (42.5%)
	High school		142 (35.7%)
	College/university degree		87 (21.9%)
Marital status	Single		43 (10.8%)
	Married		355 (89.2%)
Monthly income	Less than 500 JD		323 (81.2%)
	500 JD or more		75 (18.8%)
Do you have health Insurance?	No		84 (21.0%)
	Yes		316 (79.0%)
Medications	Insulin		150 (37.7%)
	Metformin		345 (86.7%)
	DPP-4 inhibitors		59 (14.8%)
	GLP-1-and dual GLP-1 GIP receptor agonists		15 (3.8%)
	SGLT2-Inhibitors		12 (3%)
	Sulfonylureas		38 (9.5%)
	Thiazolidinediones		7 (1.8%)
Number of diabetic medications		2 (1–2)	
Median **JDHLQ score**		22 (range 18–25)	

Abberviation: JD, Jordanian dinar; 1 JD is equivalent to $1.4.

Table 2 Participant's Responses to MARS-5 Items

Medication adherence items	**Always**	**Often**	**Sometimes**	**Rarely**	**Never**	**Median (Percentile 25- Percentile 75)**
	Count (%)	**Count (%)**	**Count (%)**	**Count (%)**	**Count (%)**	
I forget to take them	8 (2%)	13 (3.3%)	77 (19.3%)	95 (23.8%)	206 (51.6%)	5 (4–5)
I change the dose	2 (0.5%)	5 (1.3%)	72 (18.2%)	142 (35.9%)	174 (44.1%)	4 (4–5)
I stop taking them for a while	3 (0.8%)	8 (2%)	59 (14.9%)	140 (35.4%)	186 (47%)	4 (4–5)
I decide to skip a dose	3 (0.8%)	7 (1.8%)	55 (13.9%)	151 (38%)	181 (45.6%)	4 (4–5)
I take medications less than instructed	2 (0.5%)	12 (3%)	57 (14.4%)	142 (35.9%)	183 (46.2%)	4 (4–5)
Adherence level	High adherence		281 (70.3%)			
	Low adherence		119 (29.8%)			

Note: Adapted from Al-Qerem W, Al Bawab AQ, Abusara O, Alkhatib N, Horne R. Validation of the Arabic version of medication adherence report scale questionnaire and beliefs about medication -specific questionnaire: A factor analysis study. *PLoS ONE*. 2022; 17(4): e0266606. Creative Commons.[17]

Table 3 Binary Logistic Regression Model Between Different Sociomedical Variables and Adherence Level

Variables	Odds Ratio	P-value	95% C.I. for Odds Ratio	
			Lower	Upper
Age	1.013	0.216	0.993	1.033
Gender (female vs male)	0.644	0.109	0.376	1.103
Marital status (Single vs married)	1.869	0.149	0.799	4.373
Income (=< 500 JOD vs > 500 JOD)	0.879	0.694	0.463	1.670
Education Elementary school	0.845	0.620	0.435	1.641
High school	0.786	0.476	0.405	1.526
Postgraduate education (Reference group)				
Insurance (insured vs not insured)	1.114	0.714	0.626	1.981
Insulin	0.947	0.836	0.567	1.583
Metformin	0.966	0.929	0.451	2.067
DPP4 inhibitors	0.759	0.407	0.395	1.456
Sulfonylureas	0.535	0.097	0.255	1.120
JDHLQ score	1.062	0.009	1.015	1.112

Abbreviation: JD, Jordanian dinar; 1 JD is equivalent to $1.4.

more on the MARS-5 scale and were considered to be adherent to their medication. The Cronbach's alpha value for the MARS-5 scale was 0.932, which indicates a very high reliability.

Results of the regression analysis are presented in Table 3. The results indicated that the only variable significantly associated with adherence level was the JDHLQ score. An increasing JDHLQ score significantly increased the odds of a high adherence level, with an odds ratio (OR) of 1.06 and a 95% confidence interval (CI) of 1.02–1.11 (p=0.009). The total number of medications was excluded from the analysis due to high VIF (>5) and GLP-1-and dual GLP-1 GIP receptor agonists, SGLT2-Inhibitors, and Thiazolidinediones were excluded from the analysis due to the very low number of patients receiving them (>5%).

Discussion

The present study investigated the relationship between health literacy and medication adherence among Jordanian T2DM patients, aiming to uncover insights that could inform patient education strategies and public health policies. The relationship between health literacy and medication adherence in T2DM patients presents a significant opportunity to enhance healthcare outcomes.

The findings showed that higher health literacy levels correlated positively with better medication adherence. These findings are consistent with previous research, indicating that patients who better understand their health conditions and the importance of their medications are more likely to follow prescribed treatment regimens.[21] Health literacy empowers patients by enhancing their ability to navigate the healthcare system, understand medical instructions, and recognize the significance of continuous medication adherence[13]. Most of the present study participants were of lower educational and income levels, which have been traditionally linked to lower health literacy.[10] Lower health literacy is often associated with less knowledge about diseases, poorer ability to take medications correctly, worse overall health status, and higher hospitalization rates.[22] Thus, targeted educational programs that are accessible and tailored to meet the needs of these populations, are of central importance. For example, community-based health literacy programs that incorporate local languages and cultural contexts can significantly enhance understanding and engagement.[23]

Globally, medication non-adherence is a prevalent issue, particularly among patients with chronic conditions such as diabetes, where adherence rates can be as low as 50%.[9] The findings from the current study are particularly relevant given the high prevalence of T2DM in Jordan, which stands as one of the countries with the highest incidence of the condition regionally and globally.[1] The finding that improved health literacy could bolster adherence is also corroborated by studies in other countries, such as the US and China, where similar trends have been observed.[14]

The gender disparity observed, with most of the study participants being female, prompts further investigation into how gender influences health literacy and medication adherence in the Jordanian context. Gender differences in health literacy and medication adherence are evident across various settings. For example, studies have shown that women may experience different challenges compared to men in managing health conditions due to variations in health literacy levels. This could be attributed to social and cultural factors that influence how health information is perceived and acted upon by different genders.[24] In the Jordanian context, exploring these differences can provide valuable insights into tailored health communication strategies that address these gender-specific needs and barriers.

Clinical and Policy Implications

The association between health literacy and medication adherence suggests several actionable strategies for healthcare providers and policymakers. Firstly, implementing comprehensive patient education programs that cater to the varying literacy levels of patients could have a significant impact on adherence rates. These programs should prioritize simplifying medical jargon and incorporating culturally relevant materials to enhance understanding and engagement.[25] Interactive workshops that incorporate practical, hands-on learning methods have been shown to significantly enhance medication adherence, particularly for chronic conditions. Studies have demonstrated the effectiveness of pharmacist-led interventions that employ role-play, real-life scenarios, and direct patient engagement to improve understanding and adherence.[26] Additionally, eHealth interventions, including mobile health applications and telehealth, are becoming increasingly vital in supporting medication adherence. These digital platforms offer personalized reminders and education, making them effective tools for managing chronic diseases.[27]

Studies involving patients with asthma and COPD have demonstrated that patient education programs significantly improve medication use, particularly when these programs are designed to address specific barriers faced by the patients.[28] Such educational initiatives not only increase adherence but also have the potential to empower patients to manage their health more effectively, contributing to better overall health outcomes.

Secondly, healthcare providers should undergo training to recognize signs of low health literacy and to be equipped with effective communication tools. Techniques such as the "teach-back" method can be employed to confirm that patients have understood their treatment plans. Teach-back is an evidence-based practice beneficial in various settings, including hospitals and outpatient clinics, and is often incorporated as part of structured educational strategies and in diverse settings such as emergency departments, outpatient clinics, and community health centers.[29] Training healthcare providers in this method should include emphasizing the importance of tailoring communication to meet individual patient needs and include ongoing support and reminders for healthcare providers to sustain the use of teach-back in practice[29].

Finally, policymakers should recognize health literacy as a critical component of diabetes management strategies and public health campaigns. Aiming policies at improving educational systems could provide an indirect boost in health literacy, which, in turn, enhances medication adherence and reduces long-term healthcare costs.

Strengths, Limitations, and Future Research

Only a few studies have evaluated the relationship between diabetic health literacy and medication adherence in the literature, and no similar previous studies have been conducted among Jordanian diabetic patients. Moreover, validated tools (JDHLQ and MARS-5) were adopted to conduct this study, which increases the robustness of the results. The study participants were a large number of diabetic patients from different geographical areas in Amman, the capital city of Jordan, and from different sociodemographic characteristics who were attending a main public hospital in the country that serves a huge number of patients, and that contributes to the generalizability of the study findings.

While the findings of the present study provide important insights, the study has limitations that should be addressed in future research. The cross-sectional design limits the ability to establish causality between health literacy and medication adherence. Longitudinal studies could provide more definitive evidence of causality. Moreover, the convenience sampling technique used in the present study may have led to sampling bias, as participants who were more interested in participating in the study may have been more motivated to take part, which may had led to an unevenly distributed sample.

While the study enrolled a diverse group of diabetic patients from various geographical areas and differing socio-demographic backgrounds, generalizing these findings to a broader population requires caution, as the sample may not represent the wider population of Jordan or other regions, particularly given the unique health literacy challenges posed by language differences. Further research with larger and more varied populations is necessary to validate these findings across different healthcare settings and to explore the impact of language on health literacy and medication adherence. The influence of language, as a mediating factor in health literacy, should be investigated in future studies to better understand its role in patient education and adherence outcomes.

Additionally, exploring other factors that might mediate the relationship between health literacy and adherence, such as cultural beliefs and social support, could provide a more nuanced understanding of how to improve adherence rates. Cultural beliefs can deeply influence perceptions about health and illness, affecting how patients perceive the necessity and safety of medications.[30] Equally, individuals with robust social networks are more likely to comply with medication regimens, as they often receive encouragement and reminders from family and friends to take their medicine as prescribed. This support can also extend to helping manage appointments and understanding medical information, which is particularly beneficial for those with limited health literacy.[31] Thus, such factors may affect personal and community health behaviors and thereby influence how health information is received and acted upon; therefore, it would be beneficial to explore these in future research.

While the study findings highlight a positive correlation between health literacy and medication adherence among Jordanian T2DM patients, it needs to be acknowledged that the broader clinical and policy recommendations discussed must be directly tethered to these findings. Future research should aim to substantiate the proposed interventions, such as tailored patient education programs and healthcare provider training, with larger, more diverse study populations. This approach will help ensure that the policy changes are grounded in evidence that reflects the complexity and variability of the patient experiences observed in this and similar studies.

Conclusion

The study's findings show a clear link between health literacy and medication adherence among Jordanian patients with T2DM, echoing global research that highlights the importance of understanding and managing one's health conditions. As the prevalence of T2DM continues to rise, these findings are more relevant than ever and point to a need for integrated approaches that consider interactions between literacy, behavior, and chronic disease management.

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Disclosure

The authors declare no conflicts of interest in this work.

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