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Original Research Article

MEDICATION ADHERENCE AND THE FACTORS ASSOCIATED WITH IT: A CROSS-SECTIONAL STUDY AMONG DIABETIC PATIENTS FROM AN URBAN AREA OF COIMBATORE DISTRICT IN TAMIL NADU, INDIA

Ashmicaa Nair. N[1], Sudha Ramalingam[2]

[1]*Senior Resident, Department of Community Medicine, Sree Mookambika Institute of Medical Sciences, Kanyakumari, Tamil Nadu, India.*
[2]*Professor and Head, Department of Community Medicine, PSG Institute of Medical Science and Research Institute, Coimbatore, Tamil Nadu, India.*

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Corresponding Author:
Dr. Ashmicaa Nair. N,
Senior Resident, Department of Community Medicine, Sree Mookambika Institute of Medical Sciences, Kanyakumari, Tamil Nadu, India.
Email: ashmicaa.june5@gmail.com

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ABSTRACT

Background: Medication non-adherence is a significant contributor to treatment failure in patients with diabetes mellitus. Understanding the factors behind non-adherence is crucial for developing preventive strategies to enhance medication compliance, ultimately improving diabetes management. The current study focuses on estimating the level of drug adherence and identifying the associated factors among diabetic patients.

Materials and Methods: This cross-sectional study conducted at an Urban Health Training Centre in Coimbatore from March to April 2024 involved 109 diabetic patients selected through simple random sampling. Data was gathered via face-to-face interviews using a semi-structured questionnaire. Univariate analysis was performed using the chi-square test, with significant factors further analyzed through multivariate logistic regression, with a significance level set at $p<0.05$.

Results: Of the 109 diabetic patients studied, 65% demonstrated good compliance with their medication (95% Confidence interval (CI); 60.9–69.2). Five factors were identified as statistically significant in promoting better medication adherence: the absence of side effects (Adjusted Odds Ratio (AOR) 4.31; 95% CI: 1.11-8.83), being treated by the same physician consistently (AOR 4.07; 95% CI: 1.23-7.58), performing regular physical activity (AOR 3.75; 95% CI: 1.16-6.09), knowing one's target blood sugar level (AOR 2.83; 95% CI: 1.35-4.29), and having frequent follow-ups at least every two months (AOR 3.21; 95% CI: 1.07-4.59).

Conclusions: The study found that medication adherence among type 2 diabetic patients was unsatisfactory. It suggests that improving adherence could involve raising awareness, counseling about target blood sugar levels and physical activity, prescribing drugs with few side effects, and ensuring frequent follow-ups with the same physician.

Keywords: Diabetes Mellitus, Medication adherence, urban population, General Medication Adherence Scale.

INTRODUCTION

Non-communicable diseases (NCDs), particularly diabetes, are becoming significant public health issues, contributing to global healthcare challenges and economic burdens.[1] Diabetes is a condition in which the body produces inadequate insulin to meet the needs or it can be defined as a body's inefficiency to use the insulin that was produced. Diabetes accounts for approximately 1.5 million deaths annually according to the WHO, with a noted three percent increase in mortality rates over the past two decades.[2] In India, an estimated population of 77 million people above the age of 18 years are suffering from diabetes.[3] The primary treatment goal for diabetes management is to achieve glycaemic control

and to avert complications, which can be pursued through lifestyle changes and adherence to medication. Nevertheless, non-adherence to the prescribed medication regimens has continued to be an obstacle to effective treatment outcomes in the management of diabetes. with adherence rates in developing countries typically below 50%. Medication adherence is the extent to which a patient takes the correct proportion of the prescribed medication dose over a prescribed period as directed by a healthcare professional.[4] In developing countries such as India, the rising prevalence of diabetes can be attributed to epidemiological transitions. A significant aspect of managing diabetes and postponing its associated complications is ensuring medication adherence.[5] Non-adherence to medication has significant economic and therapeutic consequences with a greater risk of developing complications, which has a direct effect on the patient's health and quality of life.[6] A recent meta-analysis of cross-sectional studies that focused on medication adherence, reported non-adherence to oral hypoglycaemic medications ranged from 30 to 90 %.[7] Ensuring medication adherence in patients with chronic conditions, especially in diabetic patients continued to be the most challenging in healthcare practice as it is a multi-factorial phenomenon that is influenced by various factors such as Demographic, sociocultural, behavioral, disease-related factors, healthcare system-related factors and medication-related factors as shown below (Fig 1).[8]

However, improving medication adherence requires targeted interventions based on thorough research to identify the predictors and contributing factors. Hence, we conducted this study to find the drug adherence level and the factors associated with it among the diabetic patients in the urban area of Coimbatore district in Tamil Nadu, India.

MATERIALS AND METHODS

Study design: Cross-sectional study

Study population: Diabetic patients residing in the field practice area of an Urban Heath Training Centre (UHTC), attached to the Department of Community Medicine of a private medical college in Tamil Nadu

Study period– From February 2024 – April 2024

Study tool: Pre-designed semi-structured questionnaire having two parts. The first section comprises questions related to the socio-demographic characteristics of the participants and factors that were found to be associated with drug adherence from previous studies. The second section was the measurement of Medication adherence by using the General Medication Adherence Scale (GMAS),[9] which has an 11-item questionnaire that provides a convenient way of tracking compliance using a combination of subjective and objective measures. Each item had four Likert scores, with a minimum score of 0 and a maximum score of 3. Overall, the maximum number of points a patient can score is 33. The items in the scale are subdivided into

1. Patient behaviour-related medication adherence questionnaires (5 items)
2. Pill/injection burden due to additional disease-related questionnaires (4 items) and
3. Third subsection is payment-related questionnaires (2 items).

GMAS is a validated tool with an internal consistency of the items for its reliability test of Cronbach alpha 0.84 and the item-level content validity indexes was 0.79.[10] The outcome score used to categorize the medication adherence level as low adherence and high adherence was determined by computing the sum of each item score. If the overall GMAS score is less than 26, the patients are categorized under low adherence, and patients with GMAS score greater than or equal to 27 are categorized under high adherence.[10]

Sample size

An earlier study on drug adherence among diabetic patients done by Deepak Sharma al from Chandigarh, India [11] has shown the prevalence of drug adherence to be 79.5%. Using the prevalence study formula [(3.84) PQ/d^2], 95% confidence interval and 10% of prevalence as margin of error the sample size was estimated as 99. Adding a non-response rate of 20% the value was calculated to 123. So the study was planned to enrol 125 diabetic patients.

Sampling method

The NCD register contains data on individuals with chronic diseases within the UHTC field practice area. From a pool of 1,275 diabetic patients, 125 were selected using a simple random sampling method, facilitated by SPSS-generated random numbers. Home visit was done by the principal investigator. The chosen participants were contacted and data was collected by face-to-face interview. Eligible participants included diabetic patients aged 18 and above, diagnosed at least six months prior, and currently using oral hypoglycaemic drugs or insulin. Patients who were not present at home even after two visits and those Patients who were on lifestyle modification alone were excluded from the study. The purpose of the study was explained to the participants. Informed written consent was obtained and the data was collected.

Ethical Consideration

The study was carried out after getting the Institutional Human Ethical Committee approval (IHEC)

Statistical Analysis

The study utilized Microsoft Excel for data entry and SPSS software Version 28.0 for analysis. Categorical values were reported as frequencies and percentages, with associations evaluated using the chi-square test. Initially, univariate analysis was conducted, followed by multivariate logistic regression for statistically significant variables. The adjusted odds ratios and 95% confidence intervals were calculated, with $p<0.05$ denoting statistical significance.

RESULTS

Out of the chosen 125 diabetic patients, seven participants were on lifestyle modification alone, two were not willing to participate in the study, four of them could not be contacted after two consecutive visits, two of them had expired and one had switched on to alternate medication. Hence, a total of 109 participants were enrolled in the study. The demographic profile of the study participants is shown in Table 1.

The present study showed that 65% (95% CI: 60.9 – 69.2) of the study participants had good compliance toward medication (shown in Fig 2). In the present study, 22 selected influencing factors for good compliance with medication were considered. Univariate analysis (Table 2) revealed patients with a duration of diabetes of more than 5 years, patients with a regular follow-up frequency of at least once within two months, patients whose, daily medication intake is taken care of by spouse/self, those with knowledge on target blood sugar level, have good medication adherence. In the same way, those who have not experienced any side effects due to medication, those patients who are being treated by the same physician every time, do not abuse any substance and regularly perform physical activity have better medication adherence compared to their counterparts. Whereas other influencing factors considered in the study didn't show any statistically significant association with medication adherence.

Those who were found to have statistically significant association ($p<0.05$) in univariate analysis, were further subjected to multivariate logistic regression (Table 3). It was found that those who have not experienced any side effects due to medication have better medication adherence compared to those who had experienced side effects due to medication [Adjusted Odds ratio (AOR) 4.31; 95% CI:1.11-8.83], patients who are being treated by the same physician every time have better treatment compliance compared to those treated by a different physician [AOR 4.07; 95% CI: 1.23-7.58]. Patients who are regularly performing physical activity have better medication adherence [AOR 3.75; 95%CI: 1.16-6.09]. People who know the target blood sugar level have better compliance [AOR 2.83; 95%CI: 1.35-4.29]. patients with frequent follow-ups of at least once within two months have better compliance compared to those who have fewer follow-ups frequency [AOR 3.21; 95%CI: 1.07-4.59].

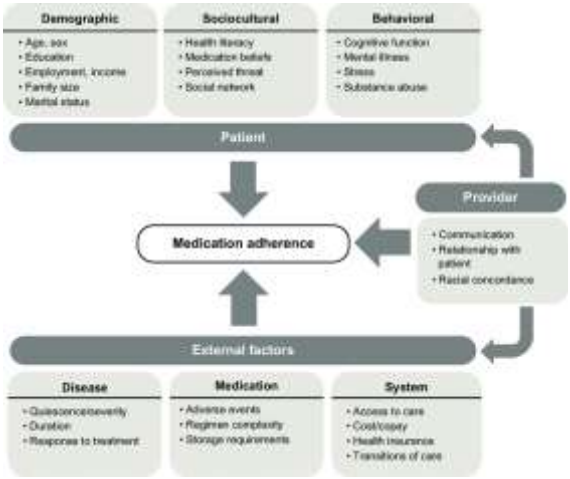

Figure 1: Conceptual Framework - Selected determinants of medication adherence,[8]

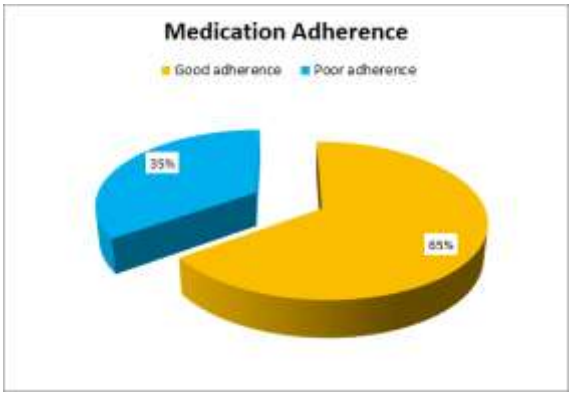

Figure 2: Distribution of Medication adherence among the study participants

Table 1: Demographic Profile of the study Participants

Variable	Category	Frequency (n=109)	Percentage
Age (in years)	20 – 40 years	17	15.6
	41-60 years	40	36.7
	Above 60 years	52	47.7
Gender	Female	58	53.2
	Male	51	46.8
Religion	Hindu	70	64.2
	Christian	23	21.1
	Muslim	15	13.8
	Others	1	0.9
Education	Illiterate	12	11.0
	Primary	10	9.2
	Middle school	18	16.5
	High school	30	27.5
	Higher secondary	18	16.5
	Degree	21	19.3
Occupation	Employed (Salaried)	55	50.5
	Unemployed	54	49.5
Marital Status	Married	85	78.0

	Unmarried	8	7.3
	Widow	15	13.8
	Divorced	1	0.9
Duration of diabetes	less than a year	21	19.3
	1-5 years	55	50.4
	5-10 years	17	15.6
	>10 years	16	14.7
Socio-economic status (Modified B. G Prasad's Classification)	Class 1	28	25.6
	Class 2	33	30.4
	Class 3	31	28.4
	Class 4	15	13.8
	Class 5	2	1.8

Table 2: Factors Influencing Medication Adherence

Variable	Category	N (109)	Good medication adherence		Poor Medication Adherence		p value
			Frequency	Percentage	Frequency	Percentage	
Age (in years)	Up to 60 years	57	37	64.9	20	35.1	0.95
	Above 60 years	52	34	65.4	18	34.6	
Gender	Female	58	39	67.2	19	32.8	0.62
	Male	51	32	62.7	19	37.3	
Religion	Hindu	70	45	64.3	25	35.7	0.80
	Others	39	26	66.7	13	33.3	
Education	Upto 8th Standard	40	24	60.0	16	40.0	0.39
	More than 8th standard	69	47	68.1	22	31.9	
Occupation	Employed (Salaried)	55	34	61.8	21	38.2	0.46
	Unemployed	54	37	68.5	17	31.5	
Marital Status	Married	85	58	68.2	27	31.8	0.20
	Others	24	13	54.2	11	45.8	
Duration of diabetes	More than 5 years	33	26	78.8	7	21.2	**0.027**
	Up to 5 years	76	45	59.2	31	40.8	
Socio-economic status	Class I,II	61	39	63.9	22	36.1	0.76
	Class III, IV, V	48	32	66.7	16	33.3	
Type of family	Nuclear	76	46	60.5	30	39.5	0.25
	Joint	33	25	75.8	8	24.2	
Type of treatment	OHA alone	105	69	65.7	36	34.3	0.52
	OHA with insulin/insulin alone	4	2	50.0	2	50.0	
Number of tablets each time	≤ 2 tablets	89	57	64.0	32	36.0	0.61
	More than 2 tablets	20	14	70.0	6	30.0	
Frequency of tablets	One a day	42	29	69.0	13	31.0	0.49
	Twice/thrice per day	67	42	62.7	25	37.3	
Frequency of follow-ups	At least once within two months	44	34	77.3	10	22.7	**0.029**
	More than 2 months once	65	37	56.9	28	43.1	
Distance of the health-seeking centre	< 5 km	61	43	70.5	18	29.5	0.186
	≥ 5 km	48	28	58.3	20	41.7	
Procurement of drug	Once a month	95	64	67.4	31	32.6	0.203
	More than once a month	14	7	50.0	7	50.0	
Medication intake taken care of by	Self/ Spouse	74	54	73.0	20	27.0	**0.013**
	Other family members	35	17	48.6	18	51.4	
Knowledge of target blood sugar level	Present	50	38	76.0	12	24.0	**0.028**
	Absent	59	33	55.9	26	44.1	
Comorbidity	Present	49	33	67.3	16	32.7	0.662
	Absent	60	38	63.3	22	36.7	
Experiencing side effects due to diabetic medication	Absent	93	66	71.0%	27	29.0	**0.002**
	Present	16	5	31.2%	11	68.8	
Payment modality for the drug	Free (From Government Centres)	22	13	59.1	9	40.9	0.72
	Full payment	87	58	66.7	29	33.3	

Being treated by the same physician every time	Yes	87	63	72.4	24	27.6	**0.002**
	No	22	8	36.4	14	63.6	
Substance Abuse (Smoking, alcohol, tobacco chewing)	Absent	41	22	53.7	19	46.3	**0.049**
	Present	68	49	72.1	19	27.9	
Doing Physical Activity	Regular	44	37	84.1	7	15.9	**0.001**
	Irregular	65	34	52.3	31	47.7	

Table 3: Multivariate Logistic Regression analysis

S No	Variable	Category	N	Odds Ratio (OR) with 95% Confidence interval (CI)	Adjusted odds ratio (AOR) 95 % CI	P value
1	Duration of diabetes	More than 5 years	33	1.33 (1.029 -1.721)	2.96 (0.89-9.86)	0.07
		Up to 5 years	76			
2	Frequency of follow-ups	At least once within 2 months.	44	2.57 (1.090-6.075)	3.21 (1.07-4.59)	**0.03**
		More than 2 months once	65			
3	Medication intake taken care of by	Spouse/ self	74	2.85 (1.236 -3.610)	2.28 (0.81-4.40)	0.11
		Other family members	35			
4	Knowledge of target blood sugar level	Present	50	1.83 (1.037-3.250)	2.83 (1.35-4.29)	**0.04**
		Absent	59			
5	Experiencing side effects due to diabetic medication	Absent	93	2.36 (1.497-3.745)	4.31 (1.11-8.83)	**0.03**
		Present	16			
6	Being treated by the same Physician every time	Yes	87	2.30 (1.450-3.670)	4.07 (1.23-7.58)	**0.02**
		No	22			
7	Substance Abuse (Smoking, alcohol, tobacco chewing)	Absent	41	1.65 (1.002-2.746)	2.46 (0.88-3.89)	0.08
		Present	68			
8	Doing Physical Activity	Regular	44	2.99 (1.45-4.19)	3.75 (1.16-6.09)	**0.02**
		Irregular	65			

DISCUSSION

Despite remarkable progress in developing and manufacturing exceedingly potent and effective drugs over the last few decades, achieving decent glycaemic control has remained elusive due to non-adherence to prescribed medications.[12,13] In the current study, it was found that good medication adherence among the study participants was 65%.

Identifying factors that influence medication adherence is crucial for designing effective strategies aimed at achieving improved glycaemic control. The current study reveals a significant finding: patients who have not experienced side effects from medication demonstrate better adherence to their prescribed treatments than those who have faced side effects. This underscores the importance of considering the impact of medication side effects on patient compliance when developing adherence strategies. A similar finding was found in another study. It highlights that fear and discomfort associated with medication may prevent patients from taking it as prescribed.[14] Our research corroborates previous studies indicating that patients with diabetes who consistently consult the same physician for their treatment exhibit significantly better adherence to their prescribed medication regimens. This suggests that continuity of care, where patients are treated by the same healthcare provider on each visit, positively influences their commitment to following medical advice and managing their condition effectively, compared to patients who see different physicians for their diabetes management.[15] A recent study indicates that patients engaging in regular physical activity exhibit better medication adherence.[16] This aligns with findings from our study, which noted that diabetic patients who maintain an active lifestyle demonstrate improved adherence to their medication regimens compared to those who do not engage in regular physical activity. The mechanism behind this phenomenon can be understood through the lens of Social Cognitive Theory, suggesting that increased exercise enhances memory and cognitive control, thereby supporting medication adherence. Regular exercise not only initiates but also sustains goal-directed behavior, which may significantly influence a patient's commitment to their medication routine. Additionally, understanding the purpose of prescribed medications and the targeted blood sugar levels expected can lead to improved medication-taking behaviors and heightened rates of adherence, as corroborated by findings in other research studies.[17,18]

Patients with follow-ups of less than two months demonstrate better medication adherence compared to those who have less frequent visits, exceeding two months. These follow-up visits facilitate open communication, enabling patients to voice concerns, share experiences, and engage in treatment decision-

making. They also serve as critical checkpoints to emphasize the necessity of adherence.[19,20] Previous studies indicate that patients with fewer medications and less frequent dosing exhibit higher adherence rates than those requiring more medications,[19] however, this correlation was not statistically significant in the current study. Various factors, such as diabetes duration, whether medication is managed by the patient or a spouse, and substance abuse, were significant in univariate analysis but did not reach statistical significance in multivariate regression analysis within this research.

CONCLUSION

World Health Organization highlighted that the impact of interventions directed to improve adherence has far greater implications than specific medical interventions.[21] Once a patient is diagnosed with diabetes, it is crucial to emphasize the significance of lifestyle modifications, including increased physical activity and adherence to a diabetic diet. Regular follow-up appointments should be scheduled to monitor the patient's blood sugar levels to ensure they remain within the target range. Health professionals, ideally the same physician, should communicate the necessity of medication adherence to manage diabetes effectively. It is also important that the chosen medication is devoid of adverse side effects to enhance patient compliance. By following these guidelines, effective glycaemic control can be achieved, aiding in the prevention of diabetes-related complications.

The study acknowledges some limitations, including its cross-sectional design which precludes the establishment of cause-effect relationships. Additionally, adherence levels were measured subjectively, potentially influenced by the truthfulness of the respondents.

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