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Original Article

Community Section

Medication Adherence among Adults with Type 2 Diabetes Mellitus: A Cross-Sectional Study at an Urban Health Training Centre in Mysuru, India

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ABSTRACT

Introduction: Diabetes is one of the four priority non-communicable diseases globally, due to its significant burden and associated complications. Effective management of diabetes requires good medication adherence, which plays a crucial role in minimising complications and adverse health outcomes. However, non adherence to diabetic medications remains a major public health challenge. Key factors contributing to poor adherence include irregular access to medications, polypharmacy (increased number of drugs), side-effects, and lack of awareness. Assessing the extent and impact of these factors is essential for developing appropriate interventions aimed at improving medication adherence among individuals with diabetes.

Aim: To estimate the proportion of medication compliance among registered patients with type 2 diabetes mellitus in the Urban Health Training Centre (UHTC) of MMCRI, Mysuru, Karnataka, India.

Materials and Methods: The present community-based cross-sectional study was conducted among registered type 2 diabetes mellitus patients under UHTC, MMCRI, Mysuru, Karnataka, India. from June 2021 to May 2022 (1 year). Inclusion criteria included consenting adult patients registered during the data collection period. A sample size of 220 was estimated based on a 50.9% adherence rate. Multistage sampling was used: Stage-1 involved selection of number of patients in each subcentres by probability proportional to size, and Stage-2 used simple random sampling to select the registered number of patients under the subcentre. Ethical clearance was obtained. Data were collected monthly by interviewing patients at their residences using a structured questionnaire. It included, sociodemographic features and medication adherence scale. Medication adherence was assessed using the 8-item Morisky Medication Adherence Scale (MMAS-8). Data were analysed using MS Excel and Statistical Package for Social Sciences (SPSS) v23, applying proportions, frequencies, and Chi-square tests (p=0.05).

Results: In the study, 107 (48.6%) of participants were male and 113 (51.3%) were female. Among them, 129 (58.6%) demonstrated good adherence to diabetic medications, 13 (5.9%) had moderate adherence, and 78 (35.45%) showed poor adherence. The findings revealed that medication adherence declined with increasing age. Additionally, factors such as socioeconomic status, gender, and educational level were significantly associated with adherence levels.

Conclusion: With the growing burden of diabetes in India, ensuring consistent medication adherence is crucial to prevent complications and enhance the overall quality of life for patients.

Keywords: Medication adherence, Morisky's medication adherence scale-8, Oral hypoglycaemic agents, Socioeconomic factors

INTRODUCTION

Diabetes Mellitus simply called 'Diabetes' is a global epidemic [1]. Diabetes is a serious, chronic metabolic disease characterised by elevated levels of blood glucose (blood sugar) [2]. It occurs when the body fails to produce enough insulin (a hormone that regulates blood glucose) or is unable to effectively use the insulin produced [3]. Today, nearly 6% of the world's population-more than 420 million individuals, have type 1 or type 2 diabetes [4]. Since 1980, this figure has quadrupled and is predicted to exceed half a billion by the end of the decade [4]. The bulk of the disease reside in low and middle-income countries [2]. Estimates in 2021 indicate that 8.7% of the adult population had diabetes. Over half (51.2%) of these were undiagnosed. India accounts for one in every seven individuals globally who have diabetes [5].

Diabetes has a massive and growing impact on health and economy. The entire cost to the healthcare system of treating type 2 diabetes patients is 1.5 times greater than per capita healthcare spending, resulting in a 66% cost burden over the general population. Furthermore, when patients have avoidable microvascular and macrovascular problems, the cost increases 2 to 3.5-fold. The direct expenses of complications caused by poor diabetes control are three to four times greater than those with good control [5]. Multi-sectoral, population-based approaches are needed to reduce the prevalence of modifiable risk factors – such as overweight, obesity, physical inactivity, and unhealthy diet - in the general population. A combination of fiscal policies, legislations, changes to the environment, and raising awareness of health risks works best for promoting healthier diets and physical activity [3].

Adherence to long-term therapy is defined as the extent to which a person's behaviour - taking medication and/or executing lifestyle changes, corresponds with agreed recommendations from a healthcare provider [6]. Medication adherence is the patient's conformance with the provider's recommendation with respect to timing, dosage, and frequency of medication-taking during the prescribed length of time [7]. A key dimension of healthcare quality is adherence to prescribed medication [8]. Antidiabetic drugs are the major treatment for type 2 diabetes mellitus patients and these agents are targeted for intensive blood glucose control which leads to a decrease in microvascular complications, such as nephropathy and retinopathy. However, non adherence to anti diabetic medication remains as one of the main reason for poor glycaemic control [9]. It causes unnecessary suffering for patients and excess costs to

healthcare system [10]. To improve patient adherence, it is important to understand why non adherence occurs [9].

Many factors can affect treatment adherence and there is no consensus on which has the greatest impact. Ruling out the possibility of no access, patient adherence can be divided into four groups of factors: patient related; related to patient provider relationship; therapeutic regimen and the disease itself [11]. Diabetic patients often have other co-morbidities that complicate their treatment regimens [10]. Other usually related disorders, in particular hypertension, obesity and depression are known to have low rates of adherence, which increases the chance of poor treatment results [12]. A complex variety of determinants clearly plays a role in patient adherence to the therapeutic regimen and contributes to non adherence of those conditions like diabetes [11].

Also several studies have been conducted in the past to determine the prevalence of diabetes mellitus in India and Karnataka, but very few studies were carried out to assess the antidiabetic medication compliance among diabetics, particularly in Karnataka [13-16]. In light of this gap, the present study was planned to highlight this critical aspect of diabetes management, with the aim of informing the development of effective strategies to address this public health concern. Specifically, the present study aimed to determine the level of medication compliance among type 2 diabetes mellitus patients.

The primary objective of the study was to estimate the proportion of medication compliance among registered patients with type 2 diabetes mellitus in the UHTC of MMCRI, Mysuru, Karnataka, India,, and the secondary objective was to assess the influence of sociodemographic determinants on medication compliance among the study subjects.

MATERIALS AND METHODS

The present community-based cross-sectional study was done to assess the medication compliance after obtaining clearance among the registered patients with type 2 diabetes mellitus in the UHTC of MMCRI, Mysuru, from June 2021 to May 2022 (1 year). Ethical clearance from the Institutional Ethical Committee {IEC No: MMC EC 25/2020}, and informed consent was obtained from the participants before data collection

Sample size calculation: The sample size was calculated to be 220 using the single proportion formula, Z2pq/d2, considering the prevalence of medication adherence 50.9% in the study done by Kumar H et al., and with relative precision of 13% [17].

The patients for the study were selected using multistage sampling. In Stage1: The required number of registered type 2 diabetes patients in each of the UHTC centres was selected by Probability Proportional to size sampling. In Stage 2: The registered type 2 diabetes patients from each subcentre were selected by simple random sampling method

Inclusion criteria: Adult registered patients with Type 2 Diabetes Mellitus in the UHTC, Nazarbad, during the data collection period and who gave written informed consent were included in the study.

Exclusion criteria: Those were not available despite two consecutive visits after contacting them over phone, messaging and visiting their house and those patients who are bedridden and unable to communicate were excluded from the study.

Study Procedure

Before starting data collection, required number of sample size was collected using random sampling techniques. The residential address of the randomly selected registered patients was obtained from the NCD register maintained at each subcentre and these were noted down. After obtaining consent from the registered patients the data was collected using interview and questionnaire method by visiting their residence. A semi-structured and validated questionnaire was used for the data collection [Annexure-1].

Questionnaire included two sections: Section-A contains sociodemographic details- age, sex, religion, education, occupation (classified using International Standard Classification of Occupations-ISCO) [18], family type and socioeconomic status (using Modified B.G. Prasad's Classification 2022) [19].

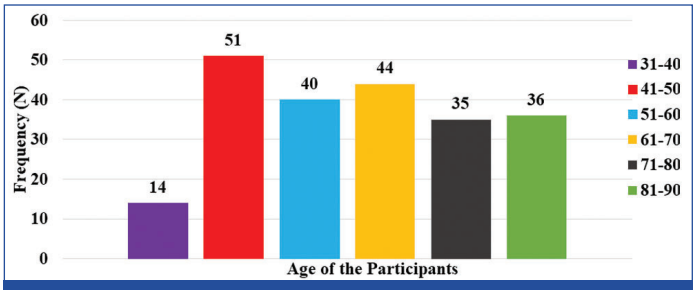
Section B included the 8-item MMAS [20], a widely validated tool designed to assess medication adherence. This scale comprises of eight questions: the first 7 ones are Yes / No questions, 0 point is given for each "NO" answer except for question no 5 where 0 point is given for "Yes" answer. For item no 8 is scored on a 5-point likert scale; where 0 point is given for "never/rarely" item and other responses score 1. The total MMAS- 8 score is the summation of the scores for the 8 questions. The total score obtained ranges from 0-8. Following is the Compliance scale format- Compliance score of 0 means high adherence, a score of 1or 2 means Medium adherence and a score above 2 is considered as low adherence [21]. The MMAS-8 has shown strong internal consistency in diabetic populations with a Cronbach's alpha of 0.83 in the Persian validation study [20], supporting its statistical reliability. In the present study, the original English version was used, where necessary questions were verbally clarified in the local language to ensure comprehension. The questionnaire was reviewed by five public health experts for content validity prior to its administration. Also, the internal consistency of MMAS- 8 in the study sample was assessed using Cronbach's alpha and found to be 0.78, reflecting acceptable reliability.

STATISTICAL ANALYSIS

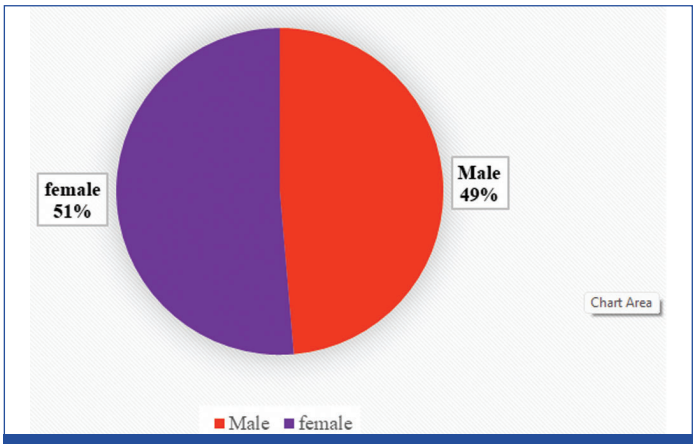
Data was entered in licensed Microsoft excel spread sheet. Data were analysed using SPSS version 23 (trial version). It was analysed using proportions, frequencies, and chi-square tests (p value <0.05 is considered significant).

RESULTS

The study was conducted among 220 type 2 diabetes mellitus registered patients. Among them, majority of the study participants belonged to the age group 41-50 years i.e., 23.1% followed by 51-60 years i.e., 18.1% [Table/Fig-1]. A 107 (49%) were males and 113 (51%) were females in The present study [Table/Fig-2]. Out of 220 study participants, 149 (67.7%) belonged to Hindu religion, 59 (26.8%) belonged to Muslim and the rest Christian religion.



[Table/Fig-1]: Age distribution of the study participants.



[Table/Fig-2]: Gender distribution among study participants.

According to Modified B G Prasad Classification 2022 [22], most of the study participants belonged to middle class family 77 (35%) followed by lower class 59 (26.8%), upper middle class 43 (19.5%), upper class 23 (10.4%) and lower middle-class family 18 (8.2%). In the study more than half (74%) were married and 40.9% belonged to nuclear family [Table/Fig-3].

S. No.	Variables	Frequency (%)
1	**Religion**	
	Hindu	149 (67.7%)
	Muslim	59 (26.8%)
	Christian	12 (5.5%)
2	**Education**	
	Illiterate	6 (2.7%)
	Primary school	69 (31.4%)
	High school	28 (12.7%)
	PUC	41 (18.6%)
	Graduate & postgraduation	76 (34.6%)
3	**Occupation**	
	Skill level 1	99 (45%)
	Skill level 2	60 (27.3%)
	Skill level 3	53 (24.1%)
	Skill level 4	8 (3.6%)
4	**Family Type**	
	Nuclear	90 (40.9%)
	Joint	53 (24.1%)
	Three generation	77 (35%)
5	**Socioeconomic Status**	
	Upper	23 (10.5%)
	Upper middle	43 (19.5%)
	Middle	77 (35%)
	Lower middle	18 (8.2%)
	Lower	59 (26.8%)

[Table/Fig-3]: Sociodemographic characteristics of study participants (N=220).

[Table/Fig-4] demonstrates the distribution of study participants according to medication adherence. Out of the 220 participants who were studied, 129 (58.63%) had high adherence to Medication, 13 (5.90%) had medium adherence and 78 (35.45%) had low adherence to diabetic medication.

S. No.	Level of medication adherence	Frequency (n)	Percentage (%)
1	Low	78	35.45 %
2	Medium	13	5.90 %
3	High	129	58.63%
Total		220	100%

[Table/Fig-4]: Distribution of study participants according to medication adherence.

As given in the [Table/Fig-5], it seen that among sociodemographic characteristics age, gender, education, occupation and socioeconomic status were found to be significantly associated with medication adherence, whereas there was no significant association between religion and medication adherence.

S. No.	Variables	Medication adherence			Chi-square	p-value*
		Low	Medium	High		
1	**Age (Years)**				16.97	<0.01
	31-40	1 (7.1)	2 (14.2)	11 (78.5)		
	41-50	4 (7.8)	5 (9.8)	42 (82.3)		
	51-60	4 (10)	6 (15)	30 (75)		
	>61	69 (60)	0 (0)	46 (40)		
2	**Gender**				12.49	0.001
	Male	29 (27.1)	12 (11.2)	66 (61.6)		
	Female	49 (43.3)	1 (0.88)	63 (55.7)		
3	**Religion**				5.208	0.072
	Hindu	52 (34.8)	5 (3.3)	92 (61.7)		
	Muslim	20 (33.8)	8 (13.5)	31 (52.5)		
	Christian	6 (50)	0 (0)	6 (50)		
4	**Education**				12.86	0.012
	Illiterate	3 (50)	0 (0)	3 (50)		
	Primary school	63 (91.3)	0 (0)	6 (8.7)		
	High school	0 (0)	6 (21.4)	22 (78.6)		
	PUC	12 (29.2)	7 (17)	22 (53.7)		
	Graduate and postgraduation	0 (0)	0 (0)	76 (100)		
5	**Occupation**				68.251	0.001
	Skill level 1	73 (73.7)	6 (6.06)	20 (20.2)		
	Skill level 2	0 (0)	7 (11.6)	53 (88.3)		
	Skill level 3	0 (0)	0 (0)	53 (100)		
	Skill level 4	5 (62.5)	0 (0)	3 (37.5)		
6	**Family type**				18.23	0.010
	Nuclear	16 (17.7)	1 (1.1)	73 (81.1)		
	Joint	32 (60.3)	4 (7.5)	17 (32)		
	Three generation	30 (38.9)	8 (10.3)	39 (50.6)		
7	**Socioeconomic Status**				83.63	0.0002
	Upper	10 (43.3)	0 (0)	13 (56.5)		
	Upper middle	0 (0)	0 (0)	43 (100)		
	Middle	4 (5.2)	4 (5.2)	69 (89.6)		
	Lower middle	6 (33.3)	9 (44.4)	3 (16.6)		
	Lower	58 (98.3)	0 (0)	1 (1.7)		

[Table/Fig-5]: Association between medication adherence and sociodemographic factors.
*Chi-square test done. p-value <0.05 is considered significant

DISCUSSION

The present study aimed primarily to assess the level of medication adherence among type 2 diabetes mellitus patients in the UHTC of MMCRI, Mysuru, Karnataka, India. A comparison with existing literature reveals both consistency and divergence in findings.

In the current study, high medication adherence was observed in 58.63% of the participants, while 5.9% and 35.45% had medium and low adherence, respectively. This pattern aligns closely with studies conducted in Puducherry, India by Olickal JJ et al., where 39% showed poor adherence, and Arulmozhi S et al., which reported 49.3% adherence [23,24]. Similarly, Padmanabha URS et al., in Bengaluru found a comparable adherence rate of 62% [25]. These figures suggest that medication adherence in urban South Indian populations is moderate to high. However, contrasting results were reported by Mishra R et al., in Rishikesh, India, where 56% had poor adherence, and by Sahoo J et al., in Bhubaneswar, India, where only 34.14% of participants were adherent, indicating significant regional variability across India [26,27].

In international settings, Ayele BA et al., in Ethiopia observed a comparable 58.33% adherence rate, whereas Lin LK et al., in Singapore found a slightly higher adherence of 65% [28,29]. However, studies such as Sendekie AK et al., in Ethiopia and Lee CS in Taiwan found predominantly low adherence (76.9% and 57.1% non adherence respectively), highlighting how healthcare system differences and accessibility issues may influence adherence globally [30,31].

With respect to sociodemographic characteristics influencing medication adherence, the findings show that increasing age, female

gender, low education levels, unskilled occupation, joint family structure, and lower socioeconomic status significantly contributed to poor adherence. These findings align with those of Padmanabha URS et al., who also identified illiteracy, labour occupation, and age above 60 as predictors of non adherence [25]. Similarly, Nandini HC et al., found associations with marital and education status [32], while Olickal JJ et al., and Sahoo J et al., found that female gender, low-income jobs, and co-morbidities increased the likelihood of poor adherence [23,27].

Interestingly, while religion was not significantly associated with adherence in the present study, some studies such as those by Albuquerque C et al., and Mohammadi S et al., have hinted at cultural factors influencing medication-taking behaviour [33,34]. The consistent association of low education and lower socioeconomic status with poor adherence across studies suggests a clear need for targeted educational interventions and access-improvement strategies for these vulnerable groups.

In conclusion, the present findings affirm that while most patients demonstrate good medication adherence, a substantial proportion still fall into low adherence categories. Comparative analysis shows that adherence rates and influencing factors vary by region, but common determinants such as education, occupation, and economic status remain critical across contexts. Addressing these factors is essential to improving long-term outcomes for individuals with type 2 diabetes.

Limitation(s)

The present study has certain limitations. Being cross-sectional, it cannot establish causality between variables. Medication adherence was self-reported, which may be affected by recall or social desirability bias. Additionally, the study was limited to urban area, restricting generalizability.

CONCLUSION(S)

As the prevalence of Diabetes Mellitus continues to rise in India, it is increasingly important to maintain and improve the patient's adherence to medication for to prevent complications and to provide a better quality of life. All this helps in reducing the Out-Of-Pocket Expenditure (OOPE). To achieve this goal, we must understand the factors that can influence the medication adherence.

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- iThenticate Software: Aug 09, 2025 (2%)

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[ANNEXURE-1] (QUESTIONNAIRE)

Section A

1.1) Name

1.2) Age: a) 31-40 y b) 41-50 yr c) 51-60 y d) >61 y

1.3) Gender a) Male b) Female

1.4) Religion: a) Hindu b) Christian c) Muslim

1.5) Family Type: a) Nuclear b) Joint c) Three generation

1.6) Education: a) Illiterate b) Primary school
c) High school d) PUC
e) Graduate/Post Graduate

1.8) Occupation: a) Skill level 1 b) Skill level 2 c) Skill level 3
d) Skill level 4

1.9) Total income of the family per month:

1.10)Socioeconomic Status: a) Upper b) Upper middle
c) Middle d) Lower Middle
e) Lower

1.11)No. of members in the family-

Section B - Medication Adherence Using Morisky's Medication Adherence 8 Scale

2.1) Do you sometimes forget to take your medication? Yes No

2.2) People sometimes miss taking their medications for Reasons other than forgetting. Thinking over the past two weeks, were there any days when you did not take your medications?
Yes No

2.3) Have you ever cut back or stopped taking medications Without telling your doctor, because you feel worse when you took it?
Yes No

2.4) When you travel or leave home, do you sometimes forget to bring along your medications? Yes No

2.5) Did you take medication yesterday? Yes No

2.6) When you feel like your health condition is under Control do you sometimes stop taking your medications? Yes No

2.7) Taking medications every day is a real inconvenience For some people. Do you ever feel hassled about sticking to your treatment plan? Yes No

2.8) How often do you have difficulty remembering to take all your medications? Never/rarely
Once in a while
Usually
All the time