

## Medication Adherence and Predictors of Non-Adherence among Patients with Type 2 Diabetes Mellitus in Sohag, Egypt.

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### Abstract

**Background:** Diabetes mellitus is a prevalent chronic disease with a fast-growing burden worldwide. Medication adherence is considered a cornerstone in its management and plays a major role in glycemic control and hence prevention of complications. **Objective:** This study aimed to determine the magnitude and predictors of medication adherence among patients with type 2 diabetes mellitus in Sohag, Egypt. **Method:** a cross-sectional survey was conducted among 400 diabetic patients who were presented to the outpatient clinics of El-Balyana family medicine center in Sohag for follow up. A structured questionnaire that contains questions about socio-demographic and clinical data of the participants in addition to the Arabic version of Morisky eight-item Medication Adherence Scale (MMAS-8) was used in data collection **Results:** Less than half the studied diabetic patients (44.5%) were adherent to therapy. Marital status of the patient, absence of comorbid disease and diabetes complication and being educated frequently about the disease and treatment regimen were the most important predictors of medication adherence detected by the study. **Conclusion:** The level of medication adherence in the current study is low and sub-optimal, it implies the need for enhancing better education about the disease at short intervals to raise the level of adherence and hence enhance adequate glycemic control among diabetic patients.

**Keywords:** Diabetes Mellitus, Medication, adherence, predictors.

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### Introduction

Diabetes mellitus (DM) is considered one of the fast-growing public health problems, currently 285 million persons suffer from diabetes worldwide and it is estimated that by 2030 the number of diabetic patients will reach 438 million.<sup>1</sup> Adherence to medication is the core of diabetes management which also includes the adoption of a healthy lifestyle and diet.<sup>2</sup> Adherence is defined by the World Health Organization (WHO) as "the extent to which a person's behavior—taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider".<sup>3</sup>

Adherence of diabetic patients to their medications is linked to better glycemic control and lower risk of complications. On the other hand, poor medication adherence leads to the development of micro and macrovascular complications with resulting end-organ failure (kidney, eye, heart) that affect the quality of life of diabetic patients and increase mortality rate and the direct health care cost.<sup>4,5</sup>

Non-adherence to medication is very common among patients with chronic disease as according to (WHO) report in 2003, about 50% of patients with chronic diseases adhere to their medications in developed countries and it is lower in developing countries.<sup>6</sup> Medication adherence is influenced by various personal, cultural and institutional factors, such as patients' age, socioeconomic and educational level, the complexity of medication regimen, its side effects, cost, and availability, in addition to emotional wellbeing and social support of the patients and most

of these factors are interrelated.<sup>7,8</sup> According to the International Diabetes Federation, 15.2% of the adult population in Egypt are diabetic (8,850,400 persons) and it's expected that this number will be doubled in 2045.<sup>9</sup>

Despite evidence of poor adherence to medication among diabetic patients elsewhere in Egypt, data regarding adherence of patients with type 2 diabetes mellitus in upper Egypt especially Sohag, are deficient. So, this study aims to determine the magnitude and predictors of medication adherence among patients with type 2 diabetes mellitus in Sohag, Egypt.

### Method

The current study was a cross-sectional survey conducted among patients with type 2 diabetes mellitus attending outpatient's clinic of family medicine centers at El-Balyana district sohag during six months duration from 1st December 2018 to the end of May 2019.

Patients were recruited from outpatient clinics of the Family health units of El-Balyana district, Sohag during the period of the study, when fulfilling the following inclusion criteria: 1) they were diagnosed with type 2 diabetes mellitus according to the diagnostic criteria of the 10th revision of the International Classification of Diseases (ICD-10)<sup>10</sup> for at least one-year duration. 2) They were on the treatment of DM for at least six months. 3) They had complete medical records. 4) Accepted to participate

**Table (1): Relation between socio-demographic characteristics of the studied diabetic patients and medication adherence in Sohag, Egypt**

Factors	Total diabetic patients	Adherent n=178	Significance test	COR (95% CI)
	n= 400	No (%)		
<b>Age: Mean (SD): 56.01(0.9)</b>				
<40 y	33	22 (66.7)	$\chi^2=22.01, p\leq 0.001$	7.6 (3.25-7.7)
40-60y	247	131 (53)	$\chi^2=31.7, p\leq 0.001$	4.3 (2.58-7.1)
>60 y (r)	120	25 (20.8)		1
<b>Gender</b>				
Female	224	95 (42.4)	$\chi^2=0.9, p=0.3$	0.82(0.55-1.22)
Male (r)	176	83 (47.2)		1
<b>Residence</b>				
Rural	386	173 (44.8)	$\chi^2=0.45, p=0.5$	1.46 (0.48- 4.44)
Urban (r)	14	5 (35.7)		1
<b>Marital status</b>				
Unmarried	5	2 (40)	$\chi^2=0.35, p=0.5$	1.73 (0.28-10.7)
Married	229	130 (56.8)		3.4 (2.3-5.26)
Divorced or widow (r)	166	46 (27.7)	$\chi^2=31.6, p\leq 0.001$	1
<b>Education</b>				
Illiterate (r)				0.017 (0.004- 0.06)
Primary school	59	5 (8.5)	$\chi^2=32.4, p\leq 0.001$	0.16 (0.05-0.49)
High school or higher (r)	315	151 (47.9)		$\chi^2=10.3, p\leq 0.001$
	26	22 (84.6)		
<b>Occupation</b>				
Worker or governmental employee	156	97(62.2)	$\chi^2=31.2, p\leq 0.001$	3.3 (2.17- 5.03)
Non- Working (r)	244	81(33.2)	-	1

in the study and filled a written consent. Patients were excluded if they had a history of psychiatric illness or were on anti-depressant treatment and/or using psychotropic drugs as it limits their cognitive ability. Diabetic patients were selected randomly using a systematic random sample (every third patient) technique.

**Sample size:** The sample size was calculated using the Epi Info 7 software, based on the following assumption: the proportion of adherence to antidiabetic medication in the study population of 37 %, (as reported by the previous study conducted in the nearby governorate, Assuit)<sup>11</sup>, level of confidence 95% and precision 5%, and design effect 1. Accordingly, the minimal needed sample size was calculated to be 359. Finally, 400 randomly selected type 2 diabetic patients were recruited in this study.

**Data collection procedure:** Data were collected through personal interviews with type 2 diabetic patients from the predetermined places using a specially designed multi-item questionnaire after explaining the nature and aim of the study to eligible persons.

**Study instrument:** The data collection tool was a structured questionnaire that consisted of three sections: the first section included socio-demographic data of the study participants such as age, gender, residence, educational level marital state, and occupation. The second section included clinical data of the studied patients (BMI, duration since the patient was diagnosed a diabetic patient, presence or absence of comorbidity, presence or absence of complications of diabetes mellitus, whether the patient measures

blood glucose level at home regularly or not, the period since last medical checkup and whether the patient received health education session about the disease in the last six months or not). This section also included questions about the type of antidiabetic medication taken by the patient, whether oral hypoglycemic drugs, insulin, or both, whether the patient experienced side effects of medication or not, whether the price of medication was affordable by the patient or not, and, finally the level of HA1C as an indicator of glycemic control among the study subjects was also recorded. The third section was the Arabic version of Morisky eight-item Medication Adherence Scale (MMAS-8) to measure adherence to treatment. MMAS-8 is the latest generic self-reported, medication-taking behavior scale. The original English-language MMAS-8 and its Arabic version showed acceptable levels of reliability and validity. It consists of eight questions. Total scores obtained from MMAS-8 range from 0 to 8, with scores of <6 and 6 to ≤8, indicating low, medium, and high adherence, respectively. Patients with total MMAS-8 scores <6 were considered non-adherent, while MMAS-8 scores ≥ 6 were considered adherent.<sup>12, 13</sup>

#### Statistical Analysis

The statistical analysis was carried out using SPSS software for Windows (version 22.0). Regarding adherence to therapy, patients were divided into two groups those who were adherent with medication (score of 6 or higher), and the second group included patients with poor adherence (a score of less than 6). Descriptive statistics as frequencies, percentages,

**Table (2): Relation between clinical profile and therapy related characteristics of the studied diabetic patients and adherence to medication in Sohag, Egypt**

Factors	Total diabetic patients	Adherent	Significance test	COR (95% CI)
	n= 400	n=178 No (%)		
<b>BMI</b>				
Average	86	42 (48.8)	$\chi^2=2.85, p=0.09$ $\chi^2=9.05, p=0.003$	0.5 (0.25-1.1)
Overweight	269	107 (39.8)		0.36(0.18-0.7)
Obese (r)	45	29 (64.4)		1
<b>Duration of diabetes</b>				
Less than 10 y	338	169 (50.0)	$\chi^2=22.16, p\leq 0.001$	5.88 (2.8-12.3)
More than 10 y (r)	62	9 (14.5)		1
<b>Comorbid diseases</b>				
Yes	226	21 (9.3)	$\chi^2=175.1, p\leq 0.001$	0.01(0.006-0.02)
No (r)	174	157 (90.2)		1
<b>Development of complications due to DM</b>				
Yes	224	10 (4.5)	$\chi^2=58.3, p\leq 0.001$	0.002 (0.001-0.006)
No (r)	176	168 (95.5)		1
<b>Measure blood glucose level at home</b>				
Yes	224	164 (73.2)	$\chi^2=118.8, p\leq 0.001$	31.6 (16.9- 58.8)
No (r)	176	14 (8.0)		1
<b>Last medical check up</b>				
3 m ago or earlier			$\chi^2=38.3, p\leq 0.001$	3.73(2.46-5.66)
More than 3 m ago (r)	175	109 (62.3)		1
	225	69 (30.7)		
<b>Receiving health education during last 6m</b>				
No	255	51 (20.0)	$\chi^2=123.6, p\leq 0.001$	0.037(0.02-0.06)
Twice or more(r)	145	127 (87.6)		1
<b>Therapy related factors:</b>				
<b>Type of antidiabetic medication</b>				
Oral hypoglycemic	224	114 (50.9)	$\chi^2=17.1, p\leq 0.001$ $\chi^2=11.1, p\leq 0.001$	2.8 (1.7-4.6)
Insulin	64	34 (53.1)		3.09 (1.6-5.9)
both (r)	112	30 (26.8)		1
<b>Ever experienced medication side effects</b>				
Yes	259	55 (21.2)	$\chi^2=120.4, p\leq 0.100$	0.039(0.02- 0.07)
No (r)	141	123 (87.2)		1
<b>Price of medicine</b>				
Affordable	99	87 (87.9)	$\chi^2=71.7, p\leq 0.001$	16.73(8.7-32.1)
Unaffordable (r)	301	91 (30.2)		1
<b>HbA1C</b>				
Controlled $\leq 7\%$	102	90 (88.0)	$\chi^2=78.02, p\leq 0.001$	34.03 (4.6- 249.9)
Uncontrolled $>7\%$ (r)	298	88 (12.0)		1

means, and standard deviations were calculated. Association between socio-demographic and clinical factors of the studied diabetic patients and their adherence to therapy were tested using chi-square test and Binary logistic regression analysis was done. The statistical difference was considered significant when p-value was less than 0.05.

#### Ethical considerations

The researchers complied with the International Guidelines for Research Ethics. The approval for conducting this study from the Scientific Research Ethical Committee of the Faculty of Medicine, Sohag University was obtained followed by approval from the MOH for conducting the study in Balyana family medicine centers. Besides, informed consent was taken from the study participants after explaining the

**Table (3): Final model of the logistic regression analysis of predictors of adherence to medications among the studied diabetic patients in Sohag, Egypt**

purpose of the study and ensuring confidentiality and anonymity.

#### Results

A total of 400 patients with type 2 DM were enrolled in the current study. The mean age of the studied patients was  $56.01 \pm 10.9$ , more than half (56%) of them were females and the majority (96.5%), were rural residents. Detailed socioeconomic and clinical data of the studied patients and relation with medication adherence are displayed in tables (1 and 2). Based on eight items Morisky Medication Adherence Scale (MMAS-8), 44.5% of the studied patients with type 2 DM (187 patients) were adherent to antidiabetic

Predictor	B	P value	AOR (95%CI)
Marital status			
Unmarried	5.5	0.002	71.4 (5.09-.577.3)
Married	2.03	0.003	16 (2.5-108.7)
Widow or divorced (r)	-	-	-
Presence of complications to diabetes			
Yes	4.4	≤0.001	0.002 (0.00-0.16)
No (r)	-	-	-
Presence of associated disease			
Yes	3.2	≤0.001	0.04 (0.01-0.15)
No (r)	-	-	-
Had health education session in the previous 6 months			
Yes	1	0.04	4.4 (1.07- 18.3)
No (r)	-	-	-

medication. Regarding socio-demographic characteristics of the study participants, the proportion of diabetic patients who were adherent to medication was significantly higher among participants who were < 40 years or between 40 and 60 years compared to older patients (66.7 % and 53% respectively with P-value = 0.000), married (56.8% with P-value = 0.000), had high school or higher education (84.6%, p value= 0.000) and were workers or governmental employees (62.2% with p value=0.00). Regarding the association between clinical data of the studied patients and adherence to their medication, presence of other comorbid diseases, development of complications to diabetes mellitus, measuring blood glucose level at home regularly, conducting medical checkup in the previous six months, having health education session in the previous six months, were significantly associated with adherence to therapy among the studied patients (P value=0.000). regarding treatment regimen, those who were treated with insulin, patients who can afford the price of medication, and those who experienced no side effects of medications were significantly more adherent to therapy than other patients ( p-value 0.00, p- value 0.000 respectively significantly higher proportion of adherent patients measured blood glucose level at home (73.2%, P value= 0.0,0),

Table (3) shows the association of HbA1C of the studied diabetic patients with adherence to antidiabetic medications. Medication adherence was significantly associated with a low level of HbA1C and hence better glycemic control among the study subjects, as 78% of the adherent diabetic patients had a good level of HAIC (≤7%) compared to 22% of the non-adherent patients ( P-value < 0.05).

Final model of bivariate logistic regression analysis of predictors of adherence to antidiabetic medications among the study participants is illustrated in table 4. Marital status, absence of complications of diabetes, absence of comorbid disease, and receiving health education sessions in the previous six months were the most important predictors of adherence to therapy among the studied patients.

## Discussion

Recent reports from World Health Organization stated that the impacts of non-adherence to therapy among diabetic patients are so alarming and efforts directed to improve adherence to therapy are better than developing new medical treatment.<sup>14</sup> This is because however new treatments are developed when patients don't take them no results in reducing complications, mortality and disease cost are gained.<sup>14</sup>

In the current study, less than half the studied patients with type 2 diabetes mellitus (44.5%) were adherent to treatment. These results are lower than the results of Ibrahim et al., in Alexandria who reported that about 57% of the study patients always took their medication as prescribed and on time.<sup>15</sup> Moreover, our results are much lower than the results of Heissam et al. in Ismailia<sup>16</sup> and Taleb and El-Shazly in Assuit,<sup>11</sup> who reported that 74% and 78% of the studied patients respectively were adherent to therapy. However, our results are higher than the results of Shams and Barakat, in Mansoura<sup>17</sup>, who found that only 38.9% of the studied diabetic patients in Mansoura University hospital were adherent to therapy.

Compared to other Arab and African countries, the rate of medication adherence in the current study is higher than that reported by Khan et al<sup>18</sup> and Aloudah et al.,<sup>19</sup> in Saudia Arabia (32% and 40% respectively), lower than the adherence level reported in in kuwait (73.9%)<sup>20</sup> and in Ethiopia (54.8%)<sup>21</sup>, and similar to Waari et al., in Kenya (45.5%).<sup>22</sup>

Of the 27 studies included in Krass et al., review, medication adherence ranged from 38.5 to 93.1%, and only six out of 27 studies (22.2%) reported prevalence of adherence of ≥ 80% among their study population.<sup>23</sup> Comparing the rate of adherence among patients with type 2 DM is difficult between different countries and between different localities in the same country. This may have resulted from difference in lifestyle, the policies and strategies adopted by different countries, awareness differences in the importance of adherence to medication, using different tools in measuring adherence and depending on patient self-report which is not always accurate. However, the reported rate of adherence in the current study remains very low and suboptimal especially when considering that depending on patient self-

report is usually associated with an over-estimated adherence level.

Inadequate control of blood glucose level can lead to several cardiovascular and nervous disorders which are leading causes of mortality of diabetic patients and account for the higher percent of expenses by those patients.<sup>4</sup> Adherence to therapy markedly reduces the risk of complications among patients with type 2 DM mainly by affecting glycemic control.<sup>24</sup> In agreement with many previous studies<sup>11, 17, 19, 20, 22</sup>, we found a significant inverse relationship between high adherence scores and lower assayed values of glycosylated haemoglobin (HbA1C) that indicated better glycemic control amongst the studied diabetic patients.

In terms of socio-demographic factors that affect adherence level, we found no significant association between medication adherence and age, gender, residence, education, and occupation of the study participants. Our results indeed, support previous research that fail to identify any significant association between these factors and adherence to therapy among patients with type 2 DM.<sup>11, 17, 19, 22, 25</sup>

Inconsistent with the previously mentioned studies, unmarried and married patients were significantly more adherents to therapy than, widow or divorced patients in the current study. The effect of patients' marital status on adherence to therapy is still unclear, but it has been suggested that family support may be a significant factor. It was suggested that married individuals tend to receive more and better health care than do unmarried.<sup>26, 27</sup> Moreover, a study that assessed drug adherence in Iranian patients with chronic diseases, have identified marriage as a significant factor in improving medication adherence.<sup>28</sup>

Patient adherence to therapy is markedly influenced by patient knowledge about disease pathology, side effects and complications and the principle of therapy that is acquired by health education. In this study diabetes health education in the prior six months was significantly associated with adherence to treatment; this is supported by results of many previous studies.<sup>17, 18, 21, 25</sup> This means that efforts in equipping diabetes clinics with oriented and well-trained health workers are beneficial in improving the awareness of the diabetic patients about their disease and hence improving adherence to therapy.

Findings of the current study collaborated with other studies in indicating an inverse relation between diabetes-related complications and adherence to therapy<sup>29, 30, 31</sup> suggesting that the development of complications is not only a result of poor adherence but could also worsen non-adherence by a huge percent.

Complex treatment regimens that includes different drugs treating more than one disease are difficult to follow and adhere to, in agreement with previous studies<sup>30, 32</sup>, we found that diabetic patients who reported the presence of other comorbid disease were significantly less adherent to therapy which implies the need for better follow-ups and regular monitoring

of adherence to therapy of such patients who are more liable to serious complications and subsequent higher mortality.

## Conclusion

The level of adherence to therapy in the current study was suboptimal as less than half the studied patients with type 2 diabetes mellitus were found adherent to medication. The marital status of the patient, the absence of comorbid disease and diabetes-related complications and being educated frequently about the disease and treatment regimen were the most important predictors of medication adherence detected by the study.

## Recommendations

Identifying the degree of adherence to therapy and predictors of optimal adherence among diabetic patients is necessary to enable stakeholders to take all the needed initiatives to tackle these factors. The current study enlightens us about the importance of providing regular follow-ups to diabetic patients which includes promotion of health education services about complications of the disease and the benefits of adherence to therapy in enhancing better glycemic control and hence reducing complications of the disease. The provided health services should also include regular and thorough monitoring of adherence to therapy especially for patients with associated comorbid diseases or socially disadvantaged as the widow or divorced patients

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**Conflict of interests:** None

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