Assessment of medication adherence among Type 2 Diabetic patients in Quetta city, Pakistan

Iqbal Q[1], Bashir S[2], Iqbal J[1], Iftikhar S[3], *Godman B[4,5].

[1]Faculty of Pharmacy & Health Sciences, University of Balochistan, Quetta, Pakistan
Emails: dr.qaiseruob@gmail.com; drjaveidiqbal@hotmail.com
[2]Faculty of Pharmacy, University of Sargodha, Punjab, Pakistan. Email: sajidpharm@gmail.com
[3]Senior Medical Officer, CENAR Hospital, Quetta, Pakistan. Email: shehla.iftikhar@gmail.com
[4]Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow, UK. Email: Brian.godman@strath.ac.uk
[5]Department of Laboratory Medicine, Division of Clinical Pharmacology, Karolinska Institutet, Karolinska University Hospital Huddinge, Stockholm, Sweden. Email: Brian.Godman@ki.se

*Correspondence author: Brian Godman, Strathclyde Institute of Pharmacy and Biomedical Sciences, University of Strathclyde, Glasgow G4 0RE, United Kingdom. Email: Brian.godman@strath.ac.uk. Telephone: 0141 548 3825. Fax: 0141 552 2562 and Department of Laboratory Medicine, Division of Clinical Pharmacology, Karolinska Institutet, Karolinska University Hospital Huddinge, SE-141 86, Stockholm, Sweden. Email: Brian.Godman@ki.se. Telephone: 00468 585 81068; Fax: 00468 585 81070

Abstract

Aims*:* Type 2 diabetes (T2DM) is a growing burden among all countries including Pakistan, with medication adherence very important. However, little is known about medication adherence in Pakistan and potential predictors among T2DM patients to provide future guidance. This needs to be addressed. Consequently, the present study sought to assess medication adherence among type 2 diabetic patients in Quetta city, Pakistan. ***Methods****:* Questionnaire based, descriptive study among 300 Pakistani patients attending public and private hospitals aged 18 years and above, having a confirmed diagnosis of T2DM, without additional co-morbidities were targeted. Descriptive statistics were used to describe demographic and disease characteristics. The association between socio-demographic data and study variables was compared through Man Whitney / Kruskal Wallis test (where applicable). The factors that were significantly associated with medication adherence were further assessed by logistic regression analysis. ***Results***: 55.6% of patients had high adherence although overall patients reported moderate adherence. Age, gender, education, diabetes-related knowledge and treatment satisfaction were significantly associated with medication adherence. Older males with only primary education and with poor diabetes-related knowledge had the lowest adherence. ***Conclusions****:* This study presents a model that is associated with medication adherence among T2DM patients, with disease-related knowledge as a significant predictor of likely adherence. Results of the current study revealed that improved diabetes related knowledge plays a significant role in improving medication adherence. Healthcare practitioners and the system should formalize and acknowledge patient education as a key component to treat patients with T2DM. This should include a greater role for pharmacists and other professionals.

Key words: Prescribing, medicine use, Diabetes, Pakistan

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Introduction

Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia due to defects in insulin secretion, insulin action or both. Type 2 Diabetes Mellitus (T2DM) accounts for approximately 90% of all DM patients.[1] Persistent hyperglycemia results in micro and macro-vascular complications, which together with their prevalence, results in DM being the seventh leading cause of death worldwide.[2]According to the International Diabetes Federation, currently 415 million people world-wide suffer from diabetes. This figure is expected to increase to 642 million by 2040[3], driven principally by a 69% increase in diabetes prevalence in developing countries.[4] Furthermore, mortality rates as high as 80% of the population due to non-communicable disease (NCDs) have been reported among developing countries.[5]
Unfortunately, the prevention and management of T2DM in low-resource settings are currently compromised by the socioeconomic situation[5]. This is a concern as the disease is manageable including pharmacotherapy with oral hypoglycemic agents, insulin or both.[6] Adherence to medicines is critical to help managing patients with T2DM, with the World Health Organization (WHO) defining adherence as the degree of patients' medication taking behaviour, executing lifestyle changes, and following a diet plan, corresponding with agreed recommendations from the health care provider.[7] In view f concerns with generally poor adherence to medicines, improving poor adherence rates in patients with T2DM with existing medicines is currently seen as more beneficial to health care systems compared with developing new medical treatments.[8]

Non-adherence of medicines in patients with T2DM arises from complex treatment regimens including multiple medications and self-care activities such as diet, exercise, foot care and regular glucose monitoring. Consequently, indicators of medication adherence are a valuable source for physicians and other professions to identify patients who are not responding to current regimens and need to improve their adherence rates.[9] Psychological problems, particularly depression, side-effects of medication, presence of barriers to care, missed appointments and high patient co-payments have all been reported as predictors of non-adherence.[10-14]

Pakistan is currently ranked seventh in the world regarding the burden of T2DM,[15] with a current incidence varying from 7.6 to 11% of the population and growing.[16-18] However to date, medication adherence has not been seen as a major concern among health care providers in Pakistan.[19] This may be because little information is currently available regarding adherence rates among these patients, although what information is available suggests poor medication adherence in practice.[20-22] We would like to add to this knowledge by looking specifically at potential key predictors of medication adherence as a starting point for developing future initiatives in Pakistan. Consequently, the objectives of this paper are to review current adherence to medicines among T2DM patients in Pakistan and possible predictors of poor adherence. Subsequently use the findings to suggest potential future initiatives that could be introduced to improve adherence rates should this be a concern given the growing prevalence of T2DM in Pakistan and the subsequent impact on morbidity, mortality and costs if not adequately addressed.

Subjects, Materials and Methods

Study design, inclusion criteria and settings

The study was designed as a questionnaire-based descriptive analysis. Pakistani nationals aged 18 years and above, having a confirmed diagnosis of T2DM, without additional co-morbidities, were targeted for the study. A diagnosis of diabetes including HbA1c levels and other disease related information was taken from medical records. Having a familiarity of Urdu (the official language of Pakistan) was also important for taking part in the study. The study was initiated in October 2015 and lasted until March 2016. T2DM patients from both public (Sandamen Provisional Hospital and Bolan Medical Complex Hospital) and private hospitals (Alkahir Hospital, Alshafi Hospital and Sajid Hospital) located in Quetta city were approached by the principal investigator (QI) for data collection at the outpatient departments of the respective hospitals. This city was chosen as being representative of Pakistan. Both public and private hospitals were included to make sure a representative sample of patients were included, with T2DM patients typically treated in out-patient clinics. Currently in Pakistan, patients attending private facilities pay 100% out of pocket. There is currently mixed payments in public facilities. The consultation is free in public institutes. However, only a limited number of medicines are available free to patients and they have to buy the rest out of pocket.

Sampling criteria

A prevalence based sampling method was used to calculate the minimum sample required for this study,[23] with a prevalence of 11% taken from reported studies.[24] However to minimize potential bias in sampling, a cumulative double design was added to the sampling initial frame and respondents were approached until we reached 300 for this study.[24]

Study variables and data collection

The study drew its frame work from the extensive literature on this subject [25-29]. The first author administered all the questionnaires and was solely involved in the data collection process. In addition to the demographics, diabetes-related knowledge and treatment satisfaction were taken as independent variables affecting medication adherence in the regression model. For prescribed medications, the medications that were prescribed for T2DM were taken into consideration. The above mentioned variables were assessed via validated questionnaires and permission was taken from the developers prior to data collection.

Assessment of medication adherence

The validated Drug Attitude Inventory (DAI-10) questionnaire in Urdu (National language of Pakistan) was used for the assessment of medication adherence.[25] DAI-10 is a generalized adherence measure consisting of ten questions that assess treatment adherence to all therapeutic regimens. Responses consist of yes or no, and scores range from 10 to –10. Patients with scores 6-10 were reported as adherent, 0-5 as moderate adherent and those in the negative ranges as non-adherent[25]. DAI-10 is frequently used for assessment of medication adherence and is previously being used in the healthcare setting of Pakistan.[30]

Assessment of diabetes-related knowledge

The validated Urdu version of Michigan Diabetes Knowledge Test (MDKT) was used for the assessment of diabetes-related knowledge.[31] The MDKT was scored as zero for incorrect response

and one for a correct response consequently, knowledge scores ranged from 0-14. The range of knowledge score was categorized in three different ways (poor knowledge < 7, average knowledge 7-11 and good knowledge > 11)[32].

Assessment of treatment satisfaction

Treatment satisfaction was based on the subjective assessment of T2DM patients' experiences towards healthcare professionals and the available facilities. The patients were given options to state the level of satisfaction as 'satisfied, being neutral or dissatisfied'.

Other patient variables

Other variables such as patients' education, occupation, income, locality, duration of the disease and family history of diabetes were asked in the questionnaire to add to the information contained in the patients' notes.

Ethical approval

Institutional Review Board, Faculty of Pharmacy, University of Sargodha, Pakistan approved the study (22-2015/PREC/FOP/UOS). Additionally, permission to conduct the study was taken from the medical superintendent of the respective institutes. Written consent was also taken from the patients prior to data collection. The patients were informed about the research initiatives, confidentiality of their responses and their right to withdraw from the study with no penalty or effects on their treatment.

Statistical analysis

The KS test was used for normality analysis and non-parametric test were used accordingly.

Descriptive statistics were used to describe demographic and disease characteristics of the patients. Percentages and frequencies were used for the categorical variables, while means and standard deviations were calculated for the continuous variables. The characteristics of the whole sample, medication adherence scores and diabetes-related knowledge scores were presented.

Medication adherence and diabetes-related knowledge were calculated using the criteria originated by the developers. The association between socio-demographic data and study variables was compared through Man Whitney / Kruskal Wallis test (where applicable). The factors that were significantly associated with medication adherence were further assessed by logistic regression analysis. The logistic regression analysis included parameters with p value < 0.05 in the Man Whitney / Kruskal Wallis test. The power of independently related parameters and predictive models were expressed as odds ratio (OR) with 95% confidence intervals (CI). SPSS v. 20.0 was used for data analysis and results for all analyses were considered statistically significant at $p<0.05$.

We did not break the patients down in those attending private or public facilities as the main difference was whether the consultation fee was free or not. However, we did break the patients down into key factors including occupation and income levels.

Results

The study was conducted from October, 2015 to March, 2016. A total of 1520 patients were treated during the recruitment period. However, only 330 subsequently fulfilled the inclusion criteria. Three hundred T2DM patients were finally incorporated in the study as the remaining patients subsequently declined to participate in the study. The description of socio-demographic variables and frequency distribution of the respondents are summarized in Table 1.

Table 1: Characteristics of the study respondents (n=300)

Characteristics	Frequency (n)	Percentage (%)
Age group (51.25±9.59)		
30-40	43	14.3
41-50	120	40.0
51-60	90	30.0
> 60	47	15.7
Gender		
Male	180	60.0
Female	120	40.0
Education		
Primary	92	30.7
Middle	41	13.7
Metric	69	23.0
Intermediate	34	11.3
Graduate	21	7.0
Postgraduate	43	14.3
Occupation		
Unemployed	127	42.3
Government Employee	84	28.0
Private Employee	35	11.7
Businessman	54	18.0
Income *(Pakistan Rupee)		
No Income	96	32.0
< 5000	64	21.3
5000-10000	46	15.3
10001-15000	13	4.3
>15000	81	27.0
Locality		
Urban	112	37.3
Rural	188	62.7
Duration of disease (years)		
Less than 1 year	54	18.0
1-3 years	97	32.3
3-5 years	58	19.3
More than 5 years	91	30.3
Family history of diabetes		
Yes	166	55.3
No	134	44.7
Number of prescribed drugs		
1-3	279	93.0
More than 3	21	7.0
Overall, are you are satisfied with present treatment?		
Satisfied	182	60.7
Neutral	33	11.0
Dissatisfied	85	28.3

The mean age (SD) of the patients was 51.25 (9.59) years, with males (60%) dominating the cohort. Ninety-two (30.7%) patients had primary level of education with 42.3% currently unemployed. 55.3% had a family history of T2DM, with 62.7% residing in rural locations. Overall, 60.7%were satisfied with their present treatment and consultation (Table 1).

Table 2 presents the level of diabetes-related knowledge in the current study respondents. Out of the 300 respondents, 210 (70.0%) were within the poor knowledge range, 83 (27.6%) moderate and only seven patients (2.3%) showed adequate general knowledge about T2DM. Poor knowledge using the MDKT-14 knowledge score was apparent in responses to questions relating to diet and disease related information. The mean knowledge score was 5.83 ±1.92, indicating generally poor diabetes-related knowledge among T2DM patients.

Table 2: Description of diabetes-related knowledge among the study participants

Diabetes Knowledge items	**Frequency (n)**	**Percent (%)**	**True (n)**	**False (n)**
The suitable diet for a diabetic is:				
The way most Pakistani people eat	171	57.0	72	228
A healthy diet for most people	77	25.7		
Too high in carbohydrate for most people	28	9.3		
Too high in protein for most people	24	8.0		
Which of the following is highest in carbohydrates?				
Baked chicken	130	43.3	54	246
Cheese	96	32.0		
Baked potato	57	19.0		
Peanut butter	17	5.7		
Which of the following is highest in fat?				
Low fat milk	146	48.7	134	166
Orange juice	117	39.0		
Corn	20	6.7		
Honey	17	5.7		
Which of the following is free food?				
Any unsweetened food	59	19.7	27	273
Any dietetic food	187	62.3		
Any food that says sugar free on the label	26	8.7		
Any food that has less than 20 calories per serving	28	9.3		
Glycosylated haemoglobin (Haemoglobin A1) is a test that is a measure of your average blood glucose level for the past:			131	169
Day	22	7.3		

Week	63	21.0		
6-10 weeks	118	39.3		
6 months	97	32.3		
Which is the best method for testing blood glucose?				
Urine test	37	12.3	144	156
Blood test	152	50.7		
Both are equally good	111	37.0		
What effect does unsweetened fruit juice have on blood glucose?				
Lowers it	69	23.0	121	179
Raises it	133	44.3		
Have no effect	98	32.7		
Which should not be used to treat low blood glucose?				
3 hard candies	144	48.0	87	213
½ cup orange juice	42	14.0		
1 cup diet soft drink	87	29.0		
1 cup skim milk	27	9.0		
For a person in good control, what effect does exercise have on blood glucose?				
Raises it	220	73.3	219	81
Lowers it	54	18.0		
Has no effect	26	8.7		
Infection is likely to cause:				
An increase in blood glucose	114	38.0	83	217
A decrease in blood glucose	85	28.3		
Has no change on blood glucose	101	33.7		
The best way to take care of your feet is to:				
Look at and wash them each day	133	44.3	145	155
Massage them with alcohol each day	66	22.0		
Soak them for one hour each day	77	25.7		
Buy shoes a size larger than usual	24	8.0		
Eating food lower in fat decrease your risk for:				
Nerve disease	115	38.3	113	186
Kidney disease	60	20.0		
Heart disease	113	37.7		
Eye disease	12	4.0		
Numbness and tingling may be symptoms of:				
Kidney disease	39	13.0	181	119
Nerve disease	178	59.3		
Eye disease	76	25.3		
Liver disease	7	2.3		
Which of the following is usually not associated with diabetes?			229	71

Vision problem	23	7.7
Kidney problem	27	9.0
Nerve problem	30	10.0
Lung problem	220	73.3

Knowledge was assessed by giving 1 to correct answer and 0 to the wrong answer. The scale measured knowledge from maximum 14 to minimum 0. Scores < 7 were taken as poor, 7 - 11 average, and >11 good knowledge of diabetes. Mean knowledge was 5.83 ±1.92

Table 3 presents the level of adherence in the current study respondents using the DAI-10. Among all the participants, 22 (7.3%) were low-adherers, 111 (37.0%) were medium adherers and 167 (55.6%) were considered adherent to medication therapies. The mean adherence score was 4.94 ± 2.72, indicating moderate level of adherence in this cohort of T2DM patients using the DAI-10 methodology.

Table 3: Description of medication adherence among the study participants

Drug adherence item	**False**		**True**	
	n	**%**	**n**	**%**
For me the good things about medication outweigh the bad	177	59.0	123	41.0
I feel uncomfortable on medication	221	73.7	79	26.3
I take medications of my own choice	25	8.3	275	91.7
Medications make me more relaxed	39	13.0	261	87.0
Medication make me tired and sluggish	164	54.7	135	45.3
I take medication only when I am sick	173	57.7	127	42.3
I feel more normal on medication	17	5.7	283	94.3
It is unnatural for my mind and body to be controlled by medications	163	54.3	137	45.7
My thoughts are clearer on medication	23	7.7	277	92.3
By staying on medications, I can prevent getting sick	20	6.7	280	93.3

Adherence was assessed by giving 1 to correct answer and -1 to the wrong answer. The scale measured adherence from a maximum of 10 to a minimum of -10. Any negative score was rated as poor adherence, 0 - 5 as moderate adherence and 6 - 10 as good adherent. Mean adherence was 4.94 ± 2.72.

Table 4 presents the cross tabulation analysis between socio-demographics and study variables. Man Whitney / Kruskal Wallis test reported a significant association between age, gender (males), education, diabetes-related knowledge ($p<0.05$). Older males having primary education and with poor diabetes-related knowledge were identified as an influencing cohort through Bonferroni correction.

No significant association was reported among other variables.

Table 4: Association among socio-demographics and medication adherence

Characteristics	P-Value*
	Medication Adherence
Age*	0.006
Gender**	*0.003*
Education*	*0.032*
Occupation*	0.077
Income*	0.450
Locality**	0.613
Duration of disease (years)*	0.795
Family history of diabetes**	0.239
Number of prescribed drugs*	0.156
Diabetes-related knowledge*	*0.032*
Treatment satisfaction**	0.066

**Kruskal Wallis test, **Man Whitney test*

Logistic regression analysis of the model was performed after entering the considered independent variables to assess potential associations. In the logistic analysis age, gender, education, diabetes-related knowledge and treatment satisfaction were included as study parameters. The created model showed a significant goodness of fit as the Omnibus Test of Model Coefficient was highly significant (Chi square =11.342, p = 0.001, df = 4). The knowledge score had a significant association (adjusted OR= 2.232, 95 % CI = 1.345 – 1.766, P < 0.001) with medication adherence. An increase in knowledge score of one point is associated with increase in good adherence by a factor of 2.232 provided other confounding factors are controlled.

Discussion

The current study aimed to highlight the predictors of medication adherence in a T2DM population attending both public and private facilities in Pakistan. As the patients were targeted randomly, chances of bias were minimized to give additional strength to the study design and findings. There appeared to be moderate adherence (Table 3), with diabetes-related knowledge appearing as a positive predictor of medication adherence (Table 4). This is encouraging as previous studies conducted in other parts of Pakistan reported poor medication adherence among diabetes patients.[19-21] Poor medication adherence has also been observed among diabetes patients in the South Asian region.[26-28] One possible reason for the differences seen between the various studies is the different methodologies used to assess medication adherence. The literature reports a number of direct and indirect adherence measures, but there currently appears no gold standard method.[29 Although different methods are advocated, a combination of measures could improve the accuracy in recording current medication adherence rates. Consequently, we believe it is wise in the future to use multiple medication adherence tools in order to obtain a better picture of current adherence rates among diabetic patients, which we attempted to undertake in this study.

Diabetes-related knowledge was reported as a predicting factor of medication adherence in the current study (Table 4). Our findings are in line with others whereby diabetes-related knowledge was found to be a correlating factor influencing medication adherence,[27, 33, 34]which is perhaps not surprising. However, developing countries are faced with limited resources, poor infrastructures and ill equipped healthcare system. Communicable diseases are generally more prevalent and less attention has typically been paid to the management of NCDs like T2DM in these countries. Additionally, when compared with communicable diseases, currently few policies have been designed and implemented at administrative levels to better manage NCDs such as T2DM.[35] However, this is changing, [5] with the WHO and others highlighting the importance of improved prevention and management of these patients including improving adherence rates with current medicines.[36] Against this, in Pakistan, patients typically pay most of their healthcare costs out-of-pocket, and the choice of consulting a registered health care professional is generally the last option. Patients generally prefer to consult other sources, including traditional healers and alternative therapists, first before seeking professional care. The poor knowledge gained can shape future medication taking behaviour and management including patients with T2DM. Consequently, in order to change the medication taking behaviour of T2DM patients, dissemination of the right information at the communal level is needed so that patients can understand the benefits of consulting registered healthcare professionals and the potential harms related to illegal and unauthorized health care practices. The findings in this study further highlight the challenges involved given variable knowledge and variable medication adherence levels even among patients attending outpatient clinics in hospitals (Table 2 and 3). This can involve all key stakeholder groups, including potentially religious leaders and others[37].

Ideally all oral medicines to treat patients with T2DM should be available free, including oral anti-diabetic medicines, medicines to control BP as well as statins given concerns with issues of co-payments, with commercial organisations believing they can supply such

medicines for US$1/ patient/ month/ medicine.[38, 39] This is a consideration for the future in Pakistan given its manufacturing base alongside suggestions to improve the quality of locally produced generics. [40

Another issue for the authorities in Pakistan to consider is collaborative care, which is typically not practiced at healthcare institutions. Physicians currently have limited interaction with pharmacists while designing therapeutic regimens for their patients[41], and pharmacists face certain barriers with providing clinical services. Currently, hospital and other pharmacists in Pakistan do not typically provide education to patients.[42] As a result, diabetes patients in Pakistan may not always receive the required information to improve their medication adherence (Table 4). Consequently, a collaborative care approach is recommended with pharmacists and other healthcare professionals, including physicians and nurses working together and providing information to patients on the medicines they should take and the need to adhere to them. As a result, patients will become more empowered. This could include potentially Diabetes Nurse Educators in the future, with such initiatives already happening in some countries[43-48] . This needs to be taken forward in Pakistan. Once patients are empowered with the right diabetes-related knowledge, medication taking behaviour can be improved (Table 4) and the objectives of treatment attained. We will be following this up with further research and initiatives to improve the care of patients with T2DM in Pakistan.

Alongside this, we will also be looking at ways to generally improve physician knowledge of medicines and their place in care since previous research has shown most physicians in Pakistan still rely on pharmaceutical companies for their source of information. [,49] Pharmacists and other professionals can play a role in developing services such as independent advice through Drugs and Therapeutic Committees to enhance future medicine selection and use.[50-] Future activities will also include researching potential ways to reduce patient reliance on traditional healers and alternative therapists, since without this care will continue to be sub-optimal.

We are aware that our study included hospitals from only one city in Pakistan. However, we believe that our findings are robust in view of the number of patients involved and provide direction for the future. We will though be following this up with further research in other cities given the concerns that we identified.

Conclusion

Medication adherence among diabetes patients is a concern across countries including Pakistan. A distinctive feature of this study is that it focused T2DM patients without co morbidities that to the best of our knowledge is the first of its kind from Pakistan. Results of the current study revealed that improved diabetes related knowledge plays a significant role in improving medication adherence. Thus, it is suggested that improved knowledge of T2DM and its management can reshape medication taking behaviour, which in return will improve glycemic control and reduce the complications associated with T2DM. Healthcare systems should formalize and acknowledge patient education as a key component of therapeutic plans in order to improve future adherence rates. As a result, help reduce the

complications associated with T2DM and the subsequent impact on morbidity, mortality and costs. Pharmacists along with physicians and other professionals can play an increasing role to improve patient care in Pakistan through co-ordinated approaches, building on the success in other countries. This should become a goal in Pakistan along with initiatives to reduce patient co-payments. Without such initiatives, care of these patients will continue to be sub-optimal.

Limitations

The study was conducted based on a prevalence based approach. We believe that the sample is representative of the region but we acknowledge that a larger scale study across different regions in Pakistan is recommended to generalize the findings.

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Conflicts of interest and funding

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