Treatment non-adherence among patients with poorly controlled type 2 diabetes in ambulatory care settings in southwestern Nigeria

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Abstract

Background: Poor adherence to prescribed therapy among patients with chronic diseases is a growing concern which undermines the benefits of current medical care.

Objectives: To evaluate the pattern of treatment non-adherence among ambulatory patients with poorly controlled type 2 diabetes in southwestern Nigeria, and to determine the possible factor(s) that accounted for such non-adherence with a view to identifying areas of future intervention to improve outcome.

Methods: A prospective cross-sectional interview using the concept of RIM (Recognize, Identify and Manage) model was used to evaluate adherence to treatment recommendations among 176 consented patients recruited from the endocrinology out-patient clinics of two teaching hospitals in southwestern Nigeria between November, 2010 and January, 2011.

Results: Overlaps of non-adherence behavior were obtained. More than three-quarter (153; 88.4%) were not aware of indication for each of the prescribed medications, 26 (15.3%) correctly described regimen as prescribed. The factorsidentified as possible barriers to medication adherence include practical (145; 40.1%), knowledge (103; 28.5%), and attitudinal (114; 31.5%) barriers. Dietary non-adherence was mostly due to inappropriate guidance (62; 33.7%).

Conclusions. The arrays of non-adherence behavior among the cohort further emphasize the need for patient-centered approach as a reasonable strategy in resolving non-adherence problems in routine clinical practice.

Key words: Type 2 diabetes, Non-adherence, Ambulatory care

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Introduction

Poor adherence to prescribed therapy is a growing concern which undermines the benefits of current medical care[1-3]. On an average, one-third to one-half of the patients for whom appropriate therapies are prescribed do not receive the full benefit from the prescribed therapeutic regimen because of inadequate adherence[4-6]. Non-adherence is especially high among patients with chronic diseases (including diabetes mellitus) that typically require long-term and sometimes complex treatment regimen to control symptoms and prevent complications, with adherence rate dropping most dramatically after the first six months of therapy[2,7].

Type 2 diabetes is a chronic disorder with increasing global pandemic and socio-economic burden[8-10]. The changes in lifestyle as a result of urbanization and westernization might have contributed to the progressive increase in the prevalence of type 2 diabetes worldwide[9-11]. The multiple variables to be considered in diabetes management typically increase the complexity of adherence enhancement and this has affected the healthcare outcome among patients[12]. In addition to taking the prescribed medications (insulin and/or oral medications) regularly and appropriately on a daily basis with minimal or no supervision, patients are also required to adhere strictly to recommended diet and exercise plans, as well as regularly monitoring and keeping a record of their own blood glucose measurements[13,14]. Overall, it is estimated that only 7% of patients with diabetes were adherent with all aspects of their treatment plans[15-17].

Poor adherence to treatment recommendations among diabetes patients typically results in suboptimal glycemic control. However, poor glycemic control has been found to be associated with increasing risk of micro- and macro-vascular complications, disease progression, morbidity and mortality with increasing costs of care[18,19]. Studies have identified varying number of reasons for non-adherence including forgetfulness, dose omission, costs and side effect of medication, as well as perceived lack of benefit from continued treatment [20,21]. Nonetheless, there exist many challenges in further understanding the pattern of non-adherence to treatment recommendations among patients with type 2 diabetes,

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especially in developing countries where the preponderance of economic instability, low literacy level, and restricted access to healthcare facilities might have led to increasing incidence of non-adherence among patients who usually make out-of-pocket payments for their treatment.

This study therefore aimed at evaluating the pattern of treatment non-adherence among patients with poorly controlled type 2 diabetes in ambulatory care settings in southwestern Nigeria, and determining the possible factor(s) that accounted for such non-adherence with a view to identifying areas of future intervention to improve outcome.

Methods

This study was carried out at the endocrinology out-patient clinics of University College Hospital (UCH), Ibadan and Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife; both were located in southwestern Nigeria. Each of the two teaching hospitals has endocrinologist-managed diabetes clinic where different categories of ambulatory and institutionalized patients within and outside the region receive treatment. Ethical approval for the study was obtained from the joint University of Ibadan/University College Hospital Institution Review Board.

A prospective cross-sectional interview guided by a pre-tested structured questionnaire designed using the concept of RIM (Recognize, Identify, and Manage) model[22] was conducted among adult patients with type 2 diabetes recruited from the out-patient endocrinology clinic of the two hospitals between 15th November, 2010 and 16th January, 2011. Patients who qualified for inclusion into the study were those who had been on antidiabetes medications for more than three months prior to the time of the study so as to ensure their familiarization with hypoglycemic medications. Eligible patients also had average of fasting blood glucose (FBG) values for the two most recent consecutive measurements > 6.11 mmol/L. This is to ensure that patients with FBG above the United Kingdom Prospective Diabetes Study (UKPDS)[23] recommended blood glucose goals (FBG ≤ 6.0 mmol/L) were enrolled. However, all type 1 diabetes patients, and type 2 diabetes patients who were unconscious or who declined participation were excluded.

The target sample size was calculated based on the assumption of 5% margin of error, and 95% confidence level with an estimated population of 340 patients for the eight weeks study period obtained from the average number of ambulatory type 2 diabetes patients (40 to 45 per week) who regularly attended the diabetes clinic of the hospitals. Based on these assumptions, a target sample size of approximately 185 was computed using a sample size calculator (www.surveysystem.com/sscal.html)[24].

Patients were approached for participation while they were waiting to see the physician on every diabetes clinic days. Objectives of the study were explained to patients individually, after which an informed written consent was obtained from individual patient to signify their willingness to participate in the study. Elderly patients were assisted by caregivers who accompanied them to the hospital, while clarifications were made for patients who did not understand English Language by the principal investigator. Translation and back-translation of responses for patients were subsequently done to maintain response consistency. Only patients who gave voluntary informed written consent for participation were enrolled. Out of 185 patients approached for participation within the study period; a total of 176 (95.1%) consented to participate from the two hospitals including 113 (64.2%) from UCH and 63 (35.8%) from OAUTHC. Participation was voluntary and patients were assured of their anonymity and confidentiality of responses.

The questionnaire used for the study was assessed for clarity and validity of content by two consultant endocrinologists and by two pharmacists who are scholars in diabetes mellitus. A pre-test of the sampling and recruitment procedures was done among fifteen randomly selected, recently diagnosed patients with type 2 diabetes chosen from the University College Hospital. Patients who were selected for the pre-test were solely considered for interaction in order to identify areas of possible challenge(s) that may be encountered during the recruitment phase of the main study, especially with respect to the appropriate strategy for sampling, as well as ease of comprehension of the item-statement in the questionnaire. These patients do not qualify for inclusion into the main study and were subsequently excluded from the final computation of data. Based on feedback from the pre-test and validity assessment, some questions were rephrased to eliminate ambiguity, in particular some questions which were initially designed in closed-ended dichotomous "Yes/No" questions were reframed as open-ended questions with relevant prompts to guide patients and ensure clarification of

intentions.

The questionnaire was divided into two sections: section A obtained information on socio-demographic data. Section B contained questions which obtained information on knowledge of duration of antidiabetes treatment plans, duration of diagnosis, and question styles which were designed using the concept of RIM model[22] to assess non-adherence behavior of patients. RIM model is a patient-centered questioning approach that provides a framework for recognizing non-adherence problem, identifying the cause of the problem as well as resolving or managing individual non-adherence deficits. The question styles in RIM model contained open-ended "Prime questions" e.g. *"What were you told the medication is used for?, how were you told to take the medication"*; and modified "Show and Tell" questions (MSTQ) e.g. "*How do you take this medication?"*. Prime questions and MSTQ were explored in order to recognize medication non-adherence problem(s) among patients. Question styles in universal statements e.g. *"Many patients have difficulty in adjusting their food styles to the prescribed diabetes diet, how are you coping with the dietary challenge?*", and reflective response e.g. "*It sounds like some of the biggest problems you have with taking your medications and other treatment recommendation as your doctor has prescribed are* _____", were also explored so as to further identify the possible factor(s) for non-adherence in individual patient.

Baseline adherence to prescribed medications and diet were assessed using self-reported medication adherence score (SRMAS) and self-reported dietary adherence score (SRDAS) with numerical rating scale ranging from one (low commitment) to ten (total or complete commitment). A binary categorization of SRMAS and SRDAS utilizing a cut-off of ≥ 8 for outstanding adherence and < 8 for poor adherence were developed based on distribution of the data and previous studies[25,26]. Patients' opinions on the extent of commitment to the recommended dietary restrictions were also evaluated in a likert scale format as "very comfortable" (assigned a score of 4), "comfortable" (3), "fairly comfortable" (2) and "uncomfortable" (1).

The questionnaire which took about 20 minutes to complete were administered to patients by the principal investigator on every diabetes clinic days of each hospital (Mondays for UCH; Thursdays for OAUTHC).

Data were sorted, coded and entered into Predictive Analytics Software (PASW) for Windows (version 17.0.). Descriptive statistics including frequency and percentage were used to summarize the data. Association between categorical variables including socio-demographic data, and adherence status in binary variables was evaluated using Chi-square or Fisher's exact test as may be appropriate. Opinion on the extent of commitment to dietary restrictions between genders was evaluated using Mann-Whitney U test with $p<0.05$ considered significant.

Results

The mean age was 60.2±10.2 years. One hundred and eight (61.4%) were females and 68 (38.6%) were males. Majority, (70; 39.8%) were traders, 37 (21.0%) were retirees, 28 (15.9%) were civil servants, 23 (13.1%) were professionals, 10 (5.7%) were unemployed, and 8 (4.5%) were artisans. Fifty-four (30.7%) had no formal education, 40 (22.7%) had primary education, 43 (24.4%) had secondary, and 39 (22.2%) had tertiary education. The mean duration of diagnosis was 6.3±5.6 years. The mean self-reported medication adherence score (SRMAS) was 7.3±1.7. Ninety-one (52.9%) gave a SRMAS of ≥ 8 indicating outstanding adherence, while 81 (47.1%) gave a SRMAS of < 8 suggesting poor medication adherence. Association between socio-demographic characteristics and SRMAS in binary categories of adherence versus non-adherence is shown in Table 1.

Non-adherence components among patients included those due to medication (55; 32.9%), diet (9; 5.4%), medication plus diet (98; 58.7%), and combination of medication, diet and exercise (5; 3.0%). Patterns of medication non-adherence behavior among patients are shown in Table 2.

Table 1: Association between socio-demographic variables and self-reported medication adherence score (SRMAS) in binary categories

Variables	Adherent (SRMAS ≥ 8) N (%)	Non-adherent (SRMAS < 8)	p –value
Age (year)			
30-40	3 (50.0)	3 (50.0)	
41-50	9 (33.3)	18 (66.7)	
51-60	31 (58.5)	22 (41.5)	0.135**
61-70	35 (59.3)	24 (40.7)	
Above 70	13 (48.1)	14 (51.9)	
Sex			
Male	38 (56.7)	29 (43.3)	
Female	53 (50.5)	52 (49.5)	0.424*
Educational qualification			
No formal education	27 (51.9)	25 (48.1)	
Primary	18 (47.4)	20 (52.6)	
Secondary	22 (51.2)	21 (48.8)	0.552*
Tertiary	24 (61.5)	15 (38.5)	
Occupation			
Traders	31 (45.6)	37 (54.4)	
Civil servant	15 (53.6)	13 (46.4)	
Artisans	4 (51.7)	3 (42.9)	
Retiree	24 (66.7)	12 (33.3)	0.331**
Professionals	13 (56.5)	10 (43.5)	
Unemployed	4 (40.0)	6 (60.0)	
Duration of diagnosis (year)			
3 months - < 1 year	6 (60.0)	4 (40.0)	
1-10	69 (52.7)	62 (47.3)	
11-20	15 (60.0)	10 (40.0)	0.097**
Above 20	1 (16.7)	5 (83.3)	

Level of significance p < 0.05, SRMAS = Self-reported medication adherence score, N= number, * Chi-square test, ** Fisher's exact test

The factors identified as possible barriers to medication adherence among patients summarily include practical (145; 40.1%), knowledge (103; 28.5%), and attitudinal (114; 31.5%) barriers. Out of the patients (15; 8.5%) who manifested the trio of knowledge, attitudinal and practical (KAP) barriers to medication adherence in combination, majority (40.0%) had no formal education compared to a proportion of 20.0%, 26.7% and 13.3% patients who had primary, secondary, and tertiary education respectively with no significant difference (p=0.18). Also, of the patients who exhibited the triple combination of KAP barriers to medication adherence, majority were traders (46.7%), followed by retirees (20.0%), civil servants and artisans constituted a proportion of 13.3% each, while 6.7% were professionals (p=0.23). In addition, majority (80.0%) of the patients with the trio of KAP barriers to medication adherence had duration of diagnosis within 1-10 years compared to a proportion of 20.0% who had duration of diagnosis within 11-20 years (p=0.35).

Evaluation of response to modified "Show and Tell" questions (MSTQ) indicated that 56 (32.9%) correctly described medication name, and dosage regimen but were inaccurate with administration of hypoglycemic medications with regard to meal time. Twenty-six (15.3%) accurately described current medications use with respect to medication name, dosage regimen, and medication administration with regard to meal time; 21 (12.4%) correctly cited medication name but were inaccurate with dosage regimen and intake with respect to meal time. Twenty (11.8%) patients got the medication name and dosage schedule correctly, but were inaccurate with medication dose and administration in accordance to meal time; 15 (8.8%) were completely inaccurate with respect to medication name, dosage regimen, and medication administration in relation to meal time; while 32 (18.8%) were unable to give any information on medication use. Of the patients who accurately described every aspects of medication-taking as prescribed, 9 (34.6%) and 8 (30.8%) had secondary and tertiary education respectively, compared to 6 (23.1%) and 3 (11.5%) patients who had primary and no formal education respectively (p=0.07). Also, among patients who correctly described medication name and dosage regimen but inaccurate with medication administration in regard to meal time, 13 (23.2%) each had primary and no formal education compared to 11(19.6%) and 19 (33.9%) patients who had secondary and tertiary educa-

Table 2: Pattern of medication non-adherence behavior among patients and factor(s) identified as possible barrier(s)

	Medication non-adherence behavior and the identified barrier (n=362)	Frequency	Percent
A	**Practical barrier**	**145**	**40.1**
	Non-refill of prescriptions due to relatively high cost of medication(s)	56	15.5
	Confusion of dosage regimen	20	5.5
	Inappropriate storage of insulin	19	5.2
	Nature of job incompatible with dosage regimen	16	4.4
	Premature discontinuation of medications due to side effects	15	4.1
	Dose omission	9	2.5
	Forgetfulness	4	1.1
	Memory/cognitive impairment	3	0.8
	Nonavailability/scarcity of prescribed brand of medication(s)	3	0.8
B	**Attitudinal barrier**	**114**	**31.5**
	Concomitant use of herbal concoction with prescribed medication	28	7.7
	Upward or downward self-adjustment of medication dosage	25	6.9
	Burden of daily intake of medication(s)	16	4.4
	Inappropriate/irrational prescription refill	12	3.3
	Not convinced of the need for prescribed medications	11	3.0
	Dislike for insulin injection	7	1.9
	Self-medication with unprescribed over-the-counter medicines	5	1.4
	Inability to carry medication around or travel/ fear of stigmatization	3	0.8
	Belief that medications need to be taken together for optimal outcome	3	0.8
	Medication discontinuation because of self-contentment	2	0.6
	Visiting multiple clinics for consultation	2	0.6
C	**Knowledge barrier**	**103**	**28.5**
	Medication use without regard to time of meal	45	12.4
	Lack of understanding of indication for specific medication prescribed	42	11.6
	Purchase of unauthorized/non-NAFDAC approved medications	6	1.7
	Assumption that prescribed medications could only be refill during clinic appointment	5	1.4
	Unaware of the need for continue intake of the prescribed hypoglycemic medications	3	0.8
	Simultaneously taking two brands of medication with same generic content	2	0.6

A, B, C subgroups = Identified barrier(s) to medication adherence; NAFDAC = National Agency for Food and Drugs, Administration and Control

tion respectively (p=0.07). In addition, of the patients who were completely inaccurate with the description of dosage regimen as prescribed, majority (6; 40.0%) had no formal education, 5 (33.3%) had primary education, 4 (26.7%) had secondary education, while none of these patients had tertiary education (p=0.07).

In addition, only 2 (1.2%) patients could correctly mention the indication for each medicine in their regimen, as well as the general purpose for the prescribed medications. Eighteen (10.4%) neither had knowledge of the general purpose of prescribed medications nor the indication for specific medicine in the regimen. More than three quarters (153; 88.4%) were not aware of the indication for each of the medications prescribed but were aware of the purpose for which the medications were generally prescribed.

Patterns of non-drug therapy recommended for patients are shown in Table 3.

Table 3: Pattern of non-drug therapy recommended for patients

Non-drug therapy (n = 176)	Frequency	Percent (%)
Dietary restriction alone	83	47.2
Dietary restriction + Moderate exercise	77	43.8
Dietary restriction + Salt restriction	7	4.0
Dietary restriction+ Moderate exercise + Salt restriction	3	1.7
Dietary restriction+ Moderate exercise + Weight reduction	3	1.7
Dietary restriction + Weight reduction	2	1.1
Dietary restriction + Exercise + Alcohol/smoking cessation	1	0.6
Summary (n = 276)		
Dietary restriction	176	63.8
Moderate exercise	84	30.4
Salt restriction	10	3.6
Weight reduction	5	1.8
Smoking and alcohol cessation	1	0.4

Majority, (90; 94.7%) complained of difficulty with dietary restrictions; 3 (3.2%) mentioned inconvenience of exercise because of work schedule or job demands; and 2 (2.1%) mentioned problem with salt restriction.

The mean self-reported dietary adherence score (SRDAS) was 6.0±1.9. Thirty-five (29.9%) gave a SRDAS of ≥ 8 indicating outstanding dietary adherence, while 82 (70.1%) gave a SRDAS score of < 8 suggesting poor

dietary adherence. There was no significant association between patients' dietary adherence status and socio-demographic characteristics with respect to age (p=0.79), sex (p=0.06), educational qualification (p=0.60) and occupation (p=0.71), as well as duration of diagnosis (p=0.65). Also, opinion on self-assessment to indicate extent of commitment to dietary restrictions among patients showed that 55 (43.3%) found dietary restrictions uncomfortable; 30 (23.6%) fairly comfortable; 40 (31.5%) comfortable, and 2 (1.6%) found adherence to dietary restrictions very comfortable. Males and females significantly differed in their opinions on extent of commitment to dietary restrictions (Mann-Whitney U = 1434.5, p = 0.02).

Barriers to optimal dietary adherence cited by patients included inappropriate guidance or education on healthy eating habits for diabetes patients (62; 33.7%), inability to desist from favourite food (60; 32.6%), nonavailability of appropriate food varieties (39; 21.2%), urge to eat to satisfaction at meal time (12; 6.5%), financial constraints to buy varieties of food (7; 3.8%), tendency to engage in eating late in the night (2; 1.1%), and 2 (1.1%) cited urge to eat outside or in the midst of friends and relatives. Thirty-nine (22.2%) reported to engage in the practice of self-monitoring of blood glucose (SMBG), and more than two-third (157; 92.4%) did not keep record of either the self-monitored or hospital-measured blood glucose results. Majority, (84; 46.7%) used to check their blood glucose status only on the appointment days. Details of patients' knowledge on diabetes self-management practices are shown in Table 4.

Table 4: Opinions on diabetes self-management practices among patients

Response	Frequency	Percent (%)
Blood glucose assessment (n =180)		
Only measured blood glucose level on the clinic appointment date	84	46.7
Through the experienced symptom(s)	55	30.6
Through self-monitoring of blood glucose	24	13.3
Only knew blood glucose level from what the doctor says in the clinic	14	7.8
Checked from the nearby clinic or chemist before the appointment date	3	1.7
Self-care measure to manage hyperglycemia (n =173)		
Use of antidiabetic medicines	56	32.3
Adjust diet	25	14.5
Go to hospital to see a physician	25	14.5
Do not know	67	38.7
Self-care measure to manage hypoglycemia (n = 145)		
Take a cube of table sugar or 15-30 centiliter of non-alcoholic soft drink	55	37.9
Never been hypoglycemic	47	32.4
Do not know	32	22.1
Eat moderate quantity of carbohydrate-containing food	9	6.2
Take medication(s)	2	1.4
Practice of self-monitoring of blood glucose [SMBG] (n = 176)		
Yes	39	22.2
No	137	77.8
If yes, frequency of SMBG		
Once/twice in a week	17	43.6
Once in a while	11	28.2
Regularly on a daily basis	7	17.9
Once in a month	4	10.3
Keeping record of blood glucose results (n=170)		
Yes	13	7.6
No	157	92.4

Discussion

From this study, there were overlaps of intentional and unintentional non-adherence among the cohort which is consistent with previous studies that identified multitude of factors responsible for treatment non-adherence among type 2 diabetes patients[27,28]. The combination of medication and dietary non-adherence noted among a significant proportion of patients might have contributed to inadequate glycemic control. Summarily, unintentional reasons for non-adherence mostly due to knowledge and practical barriers were more frequent than intentional non-adherence behaviors which were mostly attitudinal. This finding may probably be in contrast to a study which reported that intentional reasons for non-adherence are common than unintentional non-adherence[29], nonetheless, the finding further underscores the need to encourage the use of patient-centered questioning approach as entrenched in RIM model[22] as a reasonable strategy in resolving non-adherence problems in routine clinical practice.

The knowledge gaps of patients with regard to indication for each of the prescribed medications, and the inaccurate description of prescribed dosage regimens among a significant proportion of patients are partly in agreement with previous studies[30,31] which reported that over a third of patients could not identify the indication for many of their medications. The questioning approach of RIM model[22] using a style of inquiry rather than the more common "indirect" or "simple direct" methods[32] to probe for non-adherence facilitates the recognition and identification of a significant proportion of patients who were having intentional (primary) or unintentional non-adherence or combination of both.

The discrepancies in medical prescription knowledge of patients may also be a possible justification to support findings of Bonnie (1974)[33] and Scherwitz et al (1985)[34] that healthcare provider asked few questions and gave few instructions and advice for patients on chronic medical regimen *vis-a-vis* duration to take medication, as well as purpose and benefit of the medications. Nonetheless, educational background of patients may be an important determinant of the knowledge gap in medical prescription; of note in this study was the fact that patients with tertiary education constituted the largest proportion of those who accurately described every aspects of medication-taking as prescribed compared to the proportion that had either primary or no formal education. Thus, non-threatening and non-judgmental questioning styles in RIM model[22] may be a useful approach for pharmacists especially, and other healthcare provider in general to quickly verify and assess patients' understanding of their regimen, and uncover barriers to treatment adherence. Any discrepancy unearthed should be resolved therein in a time–efficient manner[35].

The most common intentional non-adherence behavior among the cohort included concomitant use of herbal remedies with prescribed allopathic medicines without disclosing the practice to their primary care physician. Even though some of the herbal remedies contain active ingredients with blood glucose lowering effect[36], indiscriminate or irrational concomitant use of herbal concoction and allopathic medicine may result in potential or actual adverse consequences, and may also lead to therapeutic failure of the allopathic medicine. Healthcare providers should therefore take cognizance of this practice of non-disclosure of herbal medicine use among patients thereby ensuring the utilization of a non-threatening and non-accusatory probe to unveil this aspect of intentional non-adherence behavior during patient-provider interaction.

Also, the practice of upward or downward self-adjustment of medication dosages among patients, as well as engaging in irrational or inappropriate refill of prescription may partly be due to the relatively high cost of prescribed medications, unfounded fears and concerns about the side effects of medication(s), and patients not being fully convinced of the necessity for continued used of the medications[37,38]. Patient-centered questioning approach may therefore be a reasonable strategy in resolving intentional and unintentional non-adherence behavior of patients. Non-refill of prescriptions due to relatively high cost of medications remains the most important reason for medication non-adherence, and this is consistent with previous studies in Nigeria[21,39,40] where financial constraint was identified as the major hindrance to medication adherence among type 2 diabetes patients.

In the present study, a relatively above average score for self-reported dietary adherence may perhaps buttress the report that indicated dietary lifestyle adjustments as one of the most challenging aspect of management for many diabetes patients[41,42]. It is noted that inappropriate guidance on healthy eating or dietary habits was the major reason for suboptimal dietary adherence among patients. This finding may be in part consistent with studies which reported that patients might be deviating from dietary recommendations due to contradictory and confusing advice from a variety of sources including healthcare professionals, media, and social contact[43,44]. The suboptimal commitment to dietary recommendations is a call for concern among diabetes primary care provider, and this possibly suggests the need to ensure provision of consistent and unequivocal dietary information for type 2 diabetes patients generally[42,45].

Although, frequent self-monitoring of blood glucose (SMBG) is significantly associated with better glycemic control[46,47], the low level of SMBG practice among significant proportion of patients has been reported in numerous studies[48,49]. It is noted in this study that almost one-half of patients got to know their blood glucose status during physician appointment only, while more than three quarters did not keep record of either the hospital-measured or self-monitored blood glucose results. Regular monitoring and keeping a record of blood glucose results are essential aspects of diabetes self-management efforts that need to be consistently emphasized and encouraged among diabetes patients at every patient-healthcare provider's encounter. More

importantly, physicians can use SMBG results to adjust medication and develop a rational treatment plan for patients[21].

Notwithstanding the useful information provided in this study, it is however limited by the fact that the self-report tools used in assessing patients' adherence are associated with some inherent problem(s) such as patients who may tend to over report good adherence or under report poor adherence. There may also be the likelihood of memory bias among patients. Nonetheless, there is no foolproof method for assessing adherence with the direct and indirect methods linked to methodological flaws[3,16,50]. Self-report measure using non-threatening and non-judgmental questions has been described as a reliable tool to assess adherence to treatment recommendations among patients[51,52].

Conclusion

It could therefore be concluded that, there were arrays of intentional and unintentional non-adherence behavior among patients with poorly controlled type 2 diabetes in ambulatory tertiary care settings used for this study. This finding may perhaps be a justification to support the need for patient-centered questioning approach as a reasonable strategy in resolving treatment non-adherence problems in routine clinical practice. Also, the poor dietary adherence and self-management practice are possible indicators for diabetes primary care providers to always ensure active involvement of patients in diabetes treatment plans in order to consistently guarantee improved treatment adherence, and subsequently optimal glycemic outcome.

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