

Factors contributing to non-compliance among diabetics attending primary health centers in the Al Hasa district of Saudi Arabia

Ataur R. Khan, Zaki N. Al-Abdul Lateef¹, Mohammad A. Al Aithan², Montaser A. Bu-Khamseen², Ibrahim Al Ibrahim³, Shabbir A. Khan³

Department of Community Ophthalmology, Al Omran Primary Health Care Center, Al Hasa, ¹PHC Affairs, Health Directorate, Al Hasa, ²Faculty of Family Medicine, College of Medicine, King Faisal University, Al Hasa, ³King Fahad Hospital, Al Hasa, Saudi Arabia

Address for correspondence: Dr. Ataur R. Khan, Department of Ophthalmology, Omran Health Center, Al Omran, Al Hasa, 31982, Saudi Arabia. E-mail: tanyaata@yahoo.com

ABSTRACT

Purpose: The purpose of the study was to measure the rate of non-compliance and the factors contributing to non-compliance among the diabetic patients in the Al Hasa region of Saudi Arabia. **Materials and Methods:** A cross-sectional survey was conducted in the Al Hasa region during the period of June 2010 to June 2011. Random sampling was carried out for the selection of 535 diabetic patients from three chronic disease centers in different parts of Al Hasa. The data were collected by means of interviewing questionnaires and file records. Any patient who had been prescribed optimum treatment and was properly advised on diet and exercise for his/her diabetes, but did not follow the medical advice, with Hb1AC of more than 7% at the time of interview, was considered as non-compliant. **Results:** The overall prevalence of therapeutic non-compliance of the participants was 67.9% (n = 318, 95% CI 63.59 – 72.02%). The non-compliance of males (69.34%) was higher than females (65.45%, P = .003). The non-compliance among the urban participants was significantly higher than (71.04 vs. 60.15%, P = .023) in the rural participants. There was a statistically significant difference in the prevalence rate of non-compliance among the participants with different levels of education. Factors found to be significantly associated with non-compliance on bi-variate analysis were: female gender (OR = 1.90, CI = 1.32-4.57), level of education (Illiteracy) (OR = 5.27, CI = 4.63 – 7.19), urban population (OR = 5.22, CI = 3.65 – 8.22), irregularity of the follow-up (OR = 8.41, CI = 4.90 – 11.92), non-adherence to drug prescription (OR = 4.55, CI = 3.54 – 5.56), non-adherence to exercise regimen (OR = 5.55, CI = 4.26 – 6.), insulin (OR = 1.29, CI = .71 – 1.87), and insulin with oral Metformin (OR = 1.20, CI = .65 – 1.75). **Conclusion:** The findings indicate that there is a high rate of non-compliance among the diabetes patients in the Al Hasa region of Saudi Arabia and there is a definite need for improvement in the healthcare system, health education, and training of diabetic patients.

Key words: Diabetes, Hb1AC, noncompliance

INTRODUCTION

Compliance in healthcare is defined as the extent to which a patient's behavior (in terms of taking medication, executing the lifestyle changes, undergoing medical tests or

keeping appointments with the physicians) coincides with the healthcare provider's recommendations for health and medical advice.^[1] Non-compliant patients are those whose health-seeking or maintenance behaviors lack congruence with the recommendations prescribed by a healthcare provider.^[2]

Patient non-compliance is a serious healthcare concern that poses a great challenge to the successful delivery of healthcare. This is widespread and has been reported from all over the world.^[3] According to a study by the New England Health Care Institute, one-third to one-half of the American patients are non-compliant.^[3] Patient

Access this article online	
Quick Response Code:	Website: www.jfcmonline.com
	DOI: 10.4103/2230-8229.94008

non-compliance is not only limited to the failure to take medication, but also the failure to make lifestyle changes, undergo tests or keep appointments with physicians. The non-compliant patients especially with chronic diseases are more prone to encountering serious difficulties.^[4]

The rate of non-compliance in patients with chronic diseases in developed countries, on long-term treatment, is on the order of 50%. This could be even higher in developing countries (WHO)^[5] One study showed that while diabetic and cardiac patients who take medication correctly have a 7% death rate; for those who are non-compliant the death rate is 12%. In another study, the rate of non-compliance ranged between 16.7 and 80% among the patients suffering from tuberculosis, hypertension, asthma, diabetes, epilepsy, and congestive cardiac failure.^[6]

A compliance study conducted in Saudi Arabia for those on short-term medication found 67.8% compliance. However, compliance of patients tend to decrease with time being lower in patients on long-term medication than in those on short-term medication.^[7] Another study done in Saudi Arabia found an overall 65.8% non-compliance in patients suffering from hypertension.^[8] The non-compliance to long-term therapy severely compromises the effectiveness of treatment and adversely affects the patient's condition.^[9]

Non-compliance can be due to factors that are patient-centered, therapy-related, or healthcare system – related.^[10] The patient-centered factors can be demographic (age, gender, educational level, and marital status) and psychological (patients' beliefs and motivation towards the therapy, negative attitude, patient-prescriber relationship, understanding of health issues, and patient's knowledge).^[2] The therapy-related factors include route of medication, duration of treatment, complexity of treatment, and the side effects of the medicines. The factors associated with the healthcare system include availability, accessibility, and the physician.

Diabetes Mellitus (DM), the most common endocrine disease in the world, is a major global public health issue.^[11] There has been an 8% increase in the prevalence of DM in Saudi Arabia in the last 10 years and at present 25% of the Saudi population is diabetic.^[12]

To the best of our knowledge, there is little or no information on the magnitude of non-compliance of the diabetic patients in the Al Hasa region of Saudi Arabia. The current study was undertaken to estimate the magnitude of the problem of non-compliance and explore the factors contributing to non-compliance of the diabetic patients of Al Hasa.

MATERIALS AND METHODS

A cross-sectional study was conducted at three chronic disease clinics, representing the different geographical areas of Al Hasa, between June 2010 and June 2011. The three chronic disease clinics were selected randomly from the lists of chronic disease clinics in the Al Hasa region. The study population included registered diabetic patients who were attending these clinics and were getting medication on a regular basis. Subjects with at least a one-year history of diabetes, and who were on a fixed drug therapy for the last six months, were selected for this study. The assumption for sample size determination was 65% prevalence of non-compliance (as observed by a study in Saudi Arabia), a 95% confidence level with a deviation of $\pm 4\%$ from true prevalence. The study population included all the diabetic patients attending the chronic disease clinics of all three health sectors of Al Hasa with about 25100 cases. To calculate the representative sample, we used Epi Info (version 6; November, 1993). With the assumption that the non-compliance of patients with diabetes could be between 65 and 69%, to achieve the confidence level of 95% we needed 535 persons with diabetes. A systematic random sampling was done to select every third diabetic patient from the appointment list of the selected chronic disease clinics. The patients who had an appointment, but did not attend the clinics on the day of the appointment were approached to complete questionnaires. The study sample was as per the population proportion to the size (PPS) of the diabetic cases in Al Hasa; Mobarraz and Faisaliya with 224 and 177 patients, respectively, belonged to the urban area, while Omran with 134 patients belonged to the rural area.

The data collected comprised age, sex, marital status, educational level, presence of other chronic diseases, duration of the DM, number of drugs taken for DM, disease control status, regularity of taking the medication, and regularity of follow-up. A trained nurse conducted an interview using structured questionnaires. The questionnaire included questions relating to their non-compliance behaviors, the extent of information they had about the medicine they were getting from a general practitioner, and difficulty to comply with the treatment. A five-point Likert type scale was used to measure the degree of response to most of the questions. However, in some, close-ended (yes or no) question types were used. The questionnaires were prepared with the help of the head of the diabetic clinic of the Al Hasa region.

The therapeutic outcome was considered in assessing the compliance of the patient. A patient who had been prescribed optimum treatment and had been given proper advice on diet and exercise for his / her diabetes, but who

did not follow the medical advice, and had Hb1AC of more than 7%, at the time of interview, was considered as non-compliant. Non-compliance was further assessed using the patients' self-report on how they had been taking their medication in the week preceding the interview and their regular attendance at the clinic. Patients were asked to recall if they had missed any doses of medication on a day-to-day basis over a period of one week. The number of tablets or injections missed was calculated based on the prescribed dose. Patients who reported taking less than 80% of their prescribed diabetes medicines were considered as failing to adhere to the treatment. Those patients who missed even a single appointment were considered as non-adherent to the chronic disease clinic appointment.^[9] Non-compliance to exercise and diet was assessed by the questionnaire as to whether the respondents followed the GP's advice on diet and exercise (taking a 20-minute walk a day at least) or not. SPSS 13 versions were used for all statistical calculations. The results were expressed as mean values \pm SD. For non-parametrical distributions, the chi square test was used. A P value of < 0.05 was considered significant.

RESULTS

A total of 468 patients participated in this study, while 67 refused, giving a response rate of 87.47%. Two-thirds of the participants were from the urban area. The average age of the participants was 58 years (SD \pm 11.64) and more than half of them were females (58.8%). The majority of the participants were uneducated (64.7%, $n = 303$). Most were married (84.4%, $n = 395$). The median duration of diabetes was 10 years (range four years – thirty-two years). The sociodemographic characteristics of the participants are summarized in Table 1.

Regarding the regularity of follow-up in the clinic only 7.9% ($n = 37$) of the participants had not missed any appointment in the last one year, while almost half of them (49.4%) had missed an appointment once or twice, and 41% ($n = 191$) more than twice. More than 50% ($n = 249$) of the participants did not attend the clinic on the day of interview; 42.9% ($n = 94$) of them mentioned unavailability of transport as the excuse for non-attendance, and 15.5% ($n = 34$) said they had forgotten, while 28.7% ($n = 63$) of them considered it unnecessary as they were taking medicine from other sources. More than half of the participants (57.5%, $n = 289$) did not adhere to the anti-diabetic medication as advised by the GP. The same obtained in the advice on exercise, where 62.6% ($n = 293$) did not follow the instructions given by the GP. However, the instructions on diet were followed by 64.7% ($n = 303$) of the participants.

Table 1: Demographic characteristics of the study sample

	Percentage	No.
Gender		
Male	41.2	193
Female	58.8	275
Geographic distribution		
Rural	28.4	133
Urban	71.6	335
Duration of diabetes		
1-5 years	20.3	95
6-10 years	29.9	140
11-15 years	24.4	114
16-20 years	18.8	88
>20 years	6.6	31
Educational level		
Illiterate	64.7	303
Primary	23.9	112
Secondary	9.6	45
College degree	1.7	8
Marital status		
Married	72	337
Never married	16.2	76
Divorced	0.9	4
Widow	10.9	51
Associated chronic disease		
None	54.1	253
Hypertension	42.9	201
Asthma	0.9	4
CHD	2.	10

Regarding the information received from the general physician, most of the patients reported that they had got enough information on 'how to take the medicine' (91%), 'how long it would take to act', (68.6%), and 'how long the medicine should be taken' (69%), but this was not true with the information regarding the side effects. Sixty-one percent of the participants did not receive any information on the side effects of the medicine and 64% did not know what to do if there were any side effects from the medicine. Most of the participants (96%, $n = 448$) agreed that the attending physicians completely understood their health problem on the day of appointment, and 90% ($n = 421$) were comfortable with the multiple drug prescriptions.

The overall prevalence of therapeutic non-compliance, that is, Hb1Ac level of more than 7 with the optimum treatment among the participants was 67.9% ($n = 318$, 95% CI 63.59 – 72.02%). The non-compliance of the males (69.34%) was higher than that of the females (65.45%, $P = .003$). The non-compliance in the urban participants was significantly higher than (71.04 vs. 60.15%, $P = .023$) in the rural participants. There was a statistically significant difference in the prevalence rate of non-compliance among the participants of different educational levels. It was highest among the illiterates (72.6%, $P = .001$), falling as the level of education rose. It was, 61.60% among those with primary school education, 47.61% among those with

secondary school education, and 45.83% in those educated beyond high school. Patients who were regular on follow-up had a significantly higher compliance rate than those who were irregular (46.88% for those who never missed an appointment, 35.53% for those who had missed an appointment once or twice in a year, 26.40% for those who had missed the appointment more than twice in a year and 18.19% for those who never attended the clinic, $P = .039$). The non-compliance was higher among the patients who did not follow the exercise regime than those who followed it (66.66% vs. 54.67%, $P = .012$). However, this did not hold for instructions on diet where non-compliance was statistically insignificant [Table 2].

The non-compliance was least (48%, $P = .003$) with the single drug regimen (Metformin) while it was highest (79.31%, $P = .003$) among patients who were on combined oral and insulin treatment. The non-compliance was also higher (79.03%, $P = .003$) in patients who were on insulin

therapy only. With regard to a multiple oral drug regime, non-compliance was more among patients who were on Metformin and Glibenclamide (66.66% Vs 61.29%, $P = .003$) than those who were on Metformin and Gliclazide [Table 2]. Physician related factors are described in Table 3.

Factors found to be significantly associated with non-compliance on bivariate analysis were: Male gender (OR = 1.90, CI = 1.32-4.57), education level (literacy) (OR = 5.27, CI = 4.63-7.19), urban population (OR = 5.22, CI = 3.65-8.22), irregularity of follow up (OR = 8.41, CI = 4.90-11.92), non-adherence to drug prescription (OR = 4.55, CI = 3.54-5.56), non-adherence to instruction on exercise (OR = 5.55, CI = 4.2-66.86), insulin (OR = 1.29, CI = .71-1.87), insulin with oral antidiabetic (OR = 1.20, CI = .65-1.75).

Age, marital status, duration of diabetes, associated chronic disease, and attendance on the day of appointment were

Table 2: Patients' related factors associated with non compliance

	Compliance %	Non compliance %	P
Geographic			
Rural	39.85	60.15	.023
Urban	28.96	71.04	
Gender			
Male	28.49	71.50	.035
Female	34.54	64.46	
Marital status			
Married	33.53	66.47	.862
Never married	26.31	73.69	
Divorced	25	75	
Widow	51.61	48.39	
Attendance on the day of appointment			
Attended	31.48	68.52	.774
Not attended	32.72	67.28	
Forgot the appointment	28.57	71.43	.000
Non availability of transport	23.7	76.3	
Did not think it necessary as he is taking medicine from other source	41.58	58.42	
Education			
Illiterate	27.4	72.6	.001
Primary school	38.4	61.60	
Secondary school	52.39	47.61	
College graduate	0	100	
Follow up in the clinic			
Never missed an appointment	46.88	53.12	.039
Missed the appointment once or twice	35.53	64.47	.039
Missed the appointment more than twice	26.40	73.60	.039
Never attended the clinic	18.19(2)	81.81 (9)	.039
Diet instruction			
Patients who followed the diet instruction	64.66	64.78	.003
Patients who did not follow the diet instruction	35.34	35.22	.981
Exercise instruction			
Patients who followed the exercise instruction	45.33	33.34	.012
Patients who did not follow the exercise instruction	54.67	66.66	
Drug regimen			
Metformin only	51.72	48.28	0.003
Glibenclamide only	38.09	61.90	0.003
Glazide only	21.43	78.57	0.003
Metformin+Glibenclamide	33.33	66.67	0.003
Metformin+Glaz	38.70	61.30	0.003
Insulin+Glazide or glibenclamide	20.98	79.02	0.003
Insulin Only	20.96	79.04	0.003

Table 3: Physician's related factors

Information received by the patient	Compliant %	Non compliant %
Information to the patient		
<i>P</i> =.023		
How to use the ant diabetic medicine		
Adequate	32.11	67.89
Little or none	25	75
How long the medicines take to act		<i>P</i> =.008
Adequate	33.87	66.13
Little or none	25.49	74.51
Whether the medicine has any untoward side effects"		<i>P</i> =.008
Adequate	40.20	59.8
Little or none	27.63	72.36
What should do if you experience the side effects"		<i>P</i> =.009
Adequate	40.25	59.74
Little or none	28.02	71.98
Interaction with the patient		
<i>P</i> =.449		
The physician completely understands your health problem when you saw him on the day of appointment		
Agree	31.02	68.98
Disagree	31.91	68.09
You feel comfortable when your physician prescribe multiple medicines for your diabetes		<i>P</i> =.449
Agree	31.99	68.01
Disagree	31.91	68.09

not significantly associated with non-compliance. However, non-compliance was significantly higher among the patients who did not attend the clinic on the day of appointment, because of unavailability of transport, than those who forgot the appointment day, and those who thought it unnecessary as they were taking medicine from other sources (78.3, 76.3, and 58.42%, respectively, $P = .000$). Patient–doctor interaction factors, such as, the patients' perception of the physician's understanding of their health problems and the patients' ease with the prescription of multiple drugs, were not significantly associated with the compliance rate.

DISCUSSION

The concept of detection and management of diabetes mellitus at a primary health care center is strongly justified and widely practiced in Saudi Arabia. However, the control of diabetes is crucially dependent on the diabetic patient's compliance to medical advice.^[13] Measuring the compliance of diabetic patients is a complex issue.^[14] Our study explored therapeutic compliance and the factors contributing to the non-compliance of diabetic patients in the Al Hasa region of Saudi Arabia.

Non-compliance with medication was higher in our study than the earlier finding in Uganda,^[15] Palestine,^[16] Hong

Kong,^[17] Mexico,^[18] and Saudi Arabia,^[19] where it was found to be 28.9, 51.4, 59, 61, and 65% (average), respectively, and lower than in India,^[20] where it was found to be 75%. However, in the Uganda study, the median duration of diabetes was four years (range one month to 38 years); in the Palestine study non-compliance was divided in two categories (51.4% poor compliance and 6.5% non-compliance). In the Saudi study, the research was conducted at only one PHC and the non-compliance was divided into different categories, such as, non-compliance to drugs (20% $P = 0.03$; OR = 14.93; 95% CI = 2.862 – 2.516), non-compliance to lifestyle modification (60%, $P = 0.010$), and non-compliance to appointments (25%, $P = 0.01$; OR = 3.16; 95% CI = 1.41 – 0.80). In our study, we measured the therapeutic non-compliance of the study population, which consisted of compliance with medication, appointments, and lifestyle changes.

There was a significant rural–urban difference in the non-compliance rate among the diabetic patients in our study. The non-compliance in the urban population was significantly higher than the rural population (71.04 vs. 60.15%, $P = .023$). The same finding has been documented in the Palestine study where the non-compliance among urban diabetic patients was higher than among the rural patients (8.2 vs. 6.2%, $P = .003$).^[16] This difference may be due to various lifestyles. Urban residents tend to be more sedentary with relatively poor dietary habits as compared to the rural population .

In our study, females were significantly more compliant (34.55 vs. 30.66%, $P = .003$). This was true of other researches conducted in various parts of the world.^[21,22] However, some studies have suggested the contrary, indicating that males were more compliant.^[15] In addition, there are a few studies which found no relationship between gender and non-compliance.^[23,24] This difference may be due to geographical variation in their education, and social factors.

In our study ,higher educational levels of patients were found to be significantly associated with a higher compliance rate of the patients,. Several studies have found the same results,^[22] while some studies have found no such association.^[23] A study conducted in the UK has shown that patients with a lower level of education have better compliance.^[24,25] It may be presumed that patients with a lower educational level may have more trust in the physician's advice. However, these results show that education may not be a good predictor of therapeutic compliance.

Irregularity of follow-up was an important factor in non-compliance in our study. The most important

causes of non-compliance with clinic appointment were the non-availability of transport, followed by forgetfulness. Forgetfulness has been widely published as an important cause of irregularity of follow-up^[26,27] It is worth mentioning here that the rural as well as the urban areas of the Al Hasa region lack good transport facilities. Besides, owing to socio-cultural factors females cannot go out on their own to a health care center.

Patient physician relationship in our study has emerged as an important factor affecting patients' compliance. Compliance was fairly high among those patients who had adequate information on the dose, duration of action, and side effects of the anti-diabetic medicines. Those patients who did not get adequate information on what to do in the event of their missing a dose, or if they experienced any side effects of the medicine, were more non-compliant. Those patients who agreed that the physician completely understood their health problem when they saw them on the day of appointment were also more compliant. Numerous researches involving various diseases have evaluated the effect of the patient-physician relationship on patients' compliance, and has found it to be another strong factor in favour of patient compliance.^[27-29] Compliance to treatment advice was good when the physicians were supportive, supplied vital information, and listened patiently to patients.^[30]

The increased rate of therapeutic non-compliance in our study resulting from the multi-drug regimen (Metformin + Sulfonylurea) and insulin injection was consistent with the previous study, which found that only 13% of the diabetic patients who were on Metformin + Sulfonylurea adhered to the regimen, as compared to those on a single drug regimen with Metformin (31%).^[31] The high non-compliance rate among the patients taking insulin agrees with other studies in which researchers found 29^[32] and 37%^[33] adherence to the medication in the study population. Non-adherence to insulin therapy in our study could be attributed to a wrong technique in injecting insulin or unavailability of someone at home to administer the injection.^[34] The results of the dietary and exercise compliance in our study showed that patients were more compliant to dietary directions than instructions on exercise (64.66 vs. 45.33%). However, the rate of compliance to diet was better than in the study done in Alexandria, Egypt, where it was found to be 58.8%. However, the rate of compliance to the exercise regime was poorer than in the Egyptian study (51.7%).^[21] This difference in results may be due to the "easier-to-follow" diet instructions, especially for females who seem to be more sedentary in Saudi Arabia than in Egypt, because of cultural constraints.

CONCLUSION

The result of this study showed that the rate of noncompliance of diabetic patients in the Al Hasa region was high. The main reasons for this were non-adherence to the anti-diabetic treatment, the appointment schedule, and the exercise and diet regimen. The level of education also played an important role in adherence to medical advice. The majority of patients who could not see the doctor on the day of appointment mentioned unavailability of transport and forgetfulness as the main reasons. This reveals that there is the need to establish some sort of system by which contact can be made with those patients who have difficulty in attending clinics and medication delivered to them on time. The PHC should have dietitian or diabetic counsellor who will give sustained encouragement and a one-to-one guidance on diet and exercise. Physician-patient relationship as well as patient's knowledge of diabetes should be improved through proper educational and training programs.

ACKNOWLEDGMENT

My special thanks go to Dr. Hussain Ahmad Al Mehdi (Technical Director, PHC Directorate), Dr. Mohammad Neil (Technical consultant, PHC Directorate), Dr. Salah Abdul Aziz Mirghani (Technical consultant, PHC affairs), Mosaad Abdul Hadi Zayed (Technical Director, A Hofuf Sector), Dr. Waleed Swelleh (Assoc. Prof, Clinical Pharmacology, Palestine), Dr. Reyazuddin Ahmad (General Practitioner), Dr. Yusuf Al Omerehal (technical director, Omran Sector), Yusuf al Najjar (Technical Supervisor, Omran sector), Dr. Khadim (Chronic Disease Specialist, Al Faisaliyah Health Care Centre), Dr. Zakaullah Khan Afghan (Resident Cardiology), Dr. Nadira Ansari (Resident, Gynecology), Dr. Shakil Ur Rahman (GP) and Ibrahim Al Hizzi (Director Omran PHC) for their active support of my research.

I am grateful to Staff Nurse Sheham Ali Nasruddin (Faisaliya), Fatima Sultan (Omran), Hafifa A hadi Zainab Al Marzook (Omran) and Wassel Yusuf who have taken great pain in helping me in Arabic to English translation and for data entry on paper as well as in the computer.

REFERENCES

1. Partridge AH, Avorn J, Wang PS, Winer EP. Adherence to therapy with oral antineoplastic agents. *J Natl Cancer Inst* 2002;94:652-61.
2. Jing J, Sklar GE, Min Sen Oh V, Chuen LiS. Factors affecting therapeutic compliance: A review from the patient's perspective. *Ther Clin Risk Manag* 2008;4:269-86.
3. Zieger A. Does Better Packaging Equal Better Patient Compliance? [Online] [Last cited on 2010 Nov 20] Available from: <http://www.pharmamanufacturing.com/articles/2005/312.html> [Last accessed on 2011 Aug 01].
4. Otcm. Assisting therapy compliance, on compliance.2011. [online] [Last cited on 2011 Apr 02] Available from: http://www.dsm.com/le/en_US/otcm/htmlsolution_therapy_effectiveness.htm. [Last accessed

- on 2011 Aug 01].
5. WHO: A report; Chronic Diseases - Poor compliance of Patients with drug treatment[online] [Last cited on 2010 Oct 02] Available from: <http://www.bio-medicine.org/medicine-news/In-Chronic-Diseases--Poor-compliance-of-Patients-with-drug-treatment--2097-1/>. [Last accessed on 2011 Aug 01].
 6. Loghman Adham-M. Medication noncompliance in patients with chronic disease: Issues in dialysis and renal transplantation. *Am J Manag Care* 2003;9:155-71.
 7. Al-Shammari SA, Khoja T, Al-Yamani MJ. Compliance with short-term antibiotic therapy among patients attending primary health center in Riyadh, Saudi Arabia. *J Royal Soc Promot Health* 1995;115:231-4.
 8. Al-Sowielem LS, Elzubier AG. Compliance and knowledge of hypertensive patients attending PHC centers in Al-Khobar, Saudi Arabia. *East Mediterr Health J* 1998;4:301-7.
 9. Abula T, Worku A. Patient noncompliance with drug regimens for chronic diseases in northeast Ethiopia. *Ethiop J Health Dev* 2001;15:185-92.
 10. Lewis A. Non-compliance: A \$100bn problem. *Remington Rep* 1997;5:14-5. [Last cited on 2010 Nov 20] Available from: [qu.edu.qa / pharmacy / documents / MEMS_Seminar_29Sep09-Semin](http://qu.edu.qa/pharmacy/documents/MEMS_Seminar_29Sep09-Semin). [Last accessed on 2011 Aug 01].
 11. Anukote CC. Epidemiology studies of diabetes mellitus in Saudi Arabia -Part 1-screening of 3158 males in King Saud University. *J R Soc Health* 1990;110:201-3.
 12. Al-Khaldi YM, Khan MY, Khairallah SH. Audit of referral of diabetic patients. *Saudi Med J* 2002;23:177-81.
 13. Federal Bureau of Prisons, Clinical Practice Guidelines Management of diabetes, 2010 [online] [Last cited on 2011 June 02] Available from: <http://www.bop.gov/news/PDFs/diabetes.pdf>. [Last accessed on 2011 Aug 01].
 14. Khattab MS, Abolfotouh MA, Khan MY, Humaidi MA, AlKaldi YM. Compliance and control of diabetes in a family practice setting, Saudi Arabia. *East Mediterr Health J* 1999;5:755-65.
 15. Kalyango JN, Owino E, Nambuya AP. Non-adherence to diabetes treatment at Mulago Hospital in Uganda: Prevalence and associated factors. *Afr Health Sci* 2008;8:67-73.
 16. Sweileh W, Aker O, Hamooz S. Rate of Compliance among Patients with Diabetes Mellitus and Hypertension. *An-Najah Univ J Res* 2005;19:1-12.
 17. Lee VW, Leung PY. Glycemic Control and Medication Compliance in Diabetic Patients in a Pharmacist-Managed Clinic in Hong Kong. *Am J Health-Syst Pharm* 2004;60:2593-5.
 18. Hernández-Ronquillo L, Téllez-Zenteno JF, Garduño-Espinosa J, González-Acevez E. Factors associated with therapy noncompliance in type-2 diabetes patients. *Salud Publica Mex* 2003;45:191-7.
 19. Khattab MS, Abolfotouh MA, Khan MY, Humaidi MA, AlKaldi YM. Compliance and control of diabetes in a family practice setting, Saudi Arabia. *East Mediterr Health J* 1999;5:755-65.
 20. Shobhana R, Begum R, Snehathatha C, Vijay V, Ramachandran A. Patients' adherence to diabetes treatment. *J Assoc Physicians India* 1999;47:1173-5.
 21. Ibrahim NK, Attia SG, Sallam SA, Fetohy EM, El-Sewi F. Physicians' therapeutic practice and compliance of diabetic patients attending rural primary health care units in Alexandria. *J Fam Community Med* 2010;17:121-8.
 22. Ghods AJ, Nasrollahzadeh D. Noncompliance with Immunosuppressive Medications after Renal Transplantation. *Tissue Antigens* 2002;60:553.
 23. Spikmans FJ, Brug J, Doven MM, Kruijenga HM, Hofsteenge GH, van Bokhorst-van der Schueren MA. Why do diabetic patients not attend appointments with their dietitian? *J Human Nutr Diet* 2003;16:151-8.
 24. Kyngas H, Lahdenpera T. Compliance of patients with hypertension and associated factors. *J Ad Nurs* 1999;29:832-9.
 25. Senior V, Marteau TM, Weinman J. Self-reported adherence to cholesterol-lowering medication in patients with familial hypercholesterolaemia: The role of illness perceptions. *J Cardiovasc Drugs Ther* 2004;18:475-81.
 26. Lee VW, Leung PY. Glycemic control and medication compliance in diabetic patients in a pharmacist-managed clinic in Hong Kong. *Am J Health Syst Pharm* 2003;60:2593-6.
 27. Hernández-Ronquillo L, Téllez-Zenteno JF, Garduño-Espinosa J, González-Acevez E. Factors associated with therapy noncompliance in type-2 diabetes patients. *Salud Publica Mex* 2003;45:191-7.
 28. Cummings KM, Kirscht JP, Binder LR, Godley AJ. Determinants of drug treatment maintenance among hypertensive persons in inner city Detroit. *Public Health Rep* 1982;97:99-106.
 29. Kim YS, Sunwoo S, Lee HR, Lee KM, Park YW, Shin HC, *et al.* Determinants of non-compliance with lipid-lowering therapy in hyperlipidemic patients. *Pharmacoepidemiol Drug Saf* 2002;11:593-600.
 30. Lawson VL, Lyne PA, Harvey JN, Bundy CE. Understanding why people with type 1 diabetes do not attend for specialist advice: A qualitative analysis of the views of people with insulin-dependent diabetes who do not attend diabetes clinic. *J Health Psychol* 2005;10:409-23.
 31. Donnan PT, MacDonald TM, Morris AD. Adherence to prescribed oral hypoglycemic medication in a population of patients with Type 2 diabetes: A retrospective cohort study. *Diabetic Med* 2002;19:279-84.
 32. Donnelly LA, Morris AD, Evans JM; DARTS / MEMO collaboration. Adherence to insulin and its association with Glycemic control in patients with type 2 diabetes. *QJM* 2007;100:345-50.
 33. Rajagopalan R, Joyce A, Smith D, Ollendorf D, Murray FT. Medication compliance in type 2 diabetes patients: Retrospective data analysis. *Value Health* 2003;6:328.
 34. Khan AR, Lateef ZN, Khamseen MA, Al- Aithan MA, Khan SA, Ibrahim IAI. Knowledge, attitude and practice of ministry of health primary health care physicians in the management of type 2 diabetes mellitus: A cross-sectional study in the Al Hasa District of Saudi Arabia, 2010. *Niger J Clin Pract* 2011;14:52-9.

How to cite this article: Khan AR, Al-Abdul Lateef ZN, Al Aithan MA, Bu-Khamseen MA, Al Ibrahim I, Khan SA. Factors contributing to non-compliance among diabetics attending primary health centers in the Al Hasa district of Saudi Arabia. *J Fam Community Med* 2012;19:26-32.
Source of Support: Nil, **Conflict of Interest:** Nil