

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

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Abstract

Objective: To assess the Knowledge Attitude and Practice (KAP) of MOH Primary Health Care Physician in the management of Type 2 Diabetes Mellitus (DM)

Materials and Methods: A cross sectional survey was conducted between April and October 2010 on MOH Primary Health Care physicians working in Al Hasa district of Saudi Arabia by filling up of pre-tested specially designed questionnaires focused on Knowledge, Attitude and practice towards Type 2 DM patients. The answers were scored by assigning marks. A SPSS 18 was used for statistical analysis.

Results: The mean of overall KAP score (\pm SD) for all the respondents were 66.59 ± 8.82 (Maximum 100). Male physicians scored better than the females physicians ($66.90, P=.018$ Vs $64.67, P=.018$) and the same was true with the rural physicians who scored higher ($68.65 \pm 10.19, P=.003$) than the urban physicians ($65.34 \pm 7.36, P=.003$). The main weakness of knowledge was on epidemiology of Diabetes Mellitus (DM). 28.3 % (n=28) of physicians didn't know the correct diagnostic criteria of Type 2 DM and only 34.7% physicians knew the correct angle of insulin injection. 86.8% (n=86) of the physicians did not agree that Diabetic Self Management Education (DSME) is an essential part of diabetic care. The mean overall KAP score was significantly higher for physicians with 1-5 years of experience ($70.16, P<.05$) than those with more than 5 years of practice ($P<.05$). This difference was found in all the segments of KAP. Overall KAP score of those GPs who had a copy of Clinical practice guidelines (CPG) in their clinic was 70.90 ± 10.94 which was higher than KAP Score of those GPs who did not have a copy of CPG ($65.10 \pm 7.01, P=.005$). Checking patients' ability to manage their diabetes, checking blood pressure, eye exam, lipids, serum creatinine, baseline ECG, chest X ray and serum electrolyte were the best followed tests while foot exam and urinary protein were performed more often than recommended in the guideline. Serum HbA_{1c} was the most delayed test.

Conclusion: This study explored several aspects of diabetes related KAP of Ministry of Health appointed GPs and identified the need for improvement in their knowledge, attitude and practices for treating Type 2 DM patients.

Key words: Attitude, knowledge, practice, type 2 diabetes

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Introduction

The World Health Organization (WHO) describes diabetes mellitus (DM) as the most common endocrine disease in the world.^[2] At present, diabetes affects more than 230 million people worldwide and, according to the most recent projections, it is expected to affect 370 million people by the year 2030.^[1] There has been an 8% increase in the prevalence of diabetes in Saudi Arabia in the recent 10 years and, presently, 25% of the Saudi population is diabetic.^[2] With the increased burden of diabetes cases in Saudi Arabia, the care of the diabetes patients has shifted from specialist care to primary care. This is the reason that many chronic disease clinics have been established recently at the different Primary Healthcare Centers (PHCs) of Saudi Arabia.

Diabetes is also one of the risk factors in renal, ocular, cardiac and vascular diseases. Therefore, knowledge of the correct methods of diagnosis and proper management of diabetes seems to be indispensable.

Because the General Practitioners (GPs) working at the different primary healthcare facilities are in the first line of treatment in Saudi Arabia, their knowledge, attitude and practice (KAP) is the determining factor in controlling the diabetes. A recent cross-sectional survey conducted in the Al

Hasa region of Saudi Arabia has showed that only 35% of the diabetes patients are properly treated or their blood sugar levels are controlled.^[3] Al Hasa, one of the largest districts of the northern province of Saudi Arabia with a population of 600,000, has 25,100 registered diabetic cases who are attending the various PHCs for their health care.^[4] Standard of professional practice is central to the role of the GPs working in this area for the care of diabetes. The evaluation of the standards of professional KAP of the GPs working at the different chronic disease clinics is also a useful tool for the policy makers to determine professional responsibility and accountability. This will help in streamlining the health care services and planning the future directions of services and protocols for the GPs.

Clinical Practice Guidelines (CPG) for diabetes care is the manual prepared by the Ministry of Health with the aim to assist the decisions of physicians for appropriate healthcare of diabetic patients. This guideline is based on the recommendation of the American Diabetic Association. CPG is expected to improve healthcare quality, to reduce the inappropriate variations in diabetic managements between the GPs and to disseminate the evidence-based medicine concept to daily practice. But, the implementation of these guidelines in diagnosis, treatment and prevention of DM is dependent on the KAP of the physicians involved in the diabetic care. However, there is no evidence that the CPG may change GPs' KAP behavior and no study has been

carried out in this region to assess the KAP of the GPs in the treatment of diabetic patients.

In the present study, the KAP of Ministry of Health-appointed GPs working at various PHCs of the Al Hasa region of Saudi Arabia was evaluated in relation to the management of the patients suffering from type 2 DM. This study also assessed the change of GPs' KAP in relation to CPG.

Materials and Methods

We conducted this cross-sectional descriptive study between April and October 2010. The study group was GPs working at the different PHCs of the Al Hasa Region of Saudi Arabia and were involved in the care of patients with diabetes. Our study population consisted of all the 150 physicians working at different PHCs of the Al Hasa region. Epi Info epidemiologic software (version 3.4.36; November, 2007, Centers for Disease Control, Atlanta, USA) was used to calculate a representative sample. To calculate the sample size, we assumed that 35% of the GPs will have poor knowledge about the treatment of type 2 diabetic cases. To achieve this at the 95% confidence level with an acceptable error of 5%, at least 102 physicians were needed. To compensate for refusal, we enrolled 10% more subjects. Thus, the calculated sample size was 122. The sampling was carried out by random selection of the required GPs from the list of GPs lying at the Health Directorate of the Al Hasa district.

A consent letter from the local Directorate of Health for Primary Health Care was obtained before starting this research. The participants were assured that the outcome would not be used for performance appraisal of the individuals. To maintain the confidentiality from the health authority, the physicians sent the completed questionnaires directly to the principal investigators, and the first page of the questionnaire containing the name of the physician was immediately removed. The questionnaires were sent to all the participants. The questionnaire, consisting of 62 questions, was designed to collect information on the demographic and professional data of the study population (12 questions), current knowledge (23 questions), attitude toward diabetic patients (15 questions) and

practices when dealing with the patients suffering from type 2 DM (12 questions). Each question of KAP was awarded 2 marks (total 100 marks) with the correct answer while each wrong answer was given a 0 mark. A 5-point Likert type scale was used to measure the degree of respondents in most of the questions. However, in some, a close-ended (yes or no) type was also used. Agree and strongly agree option of the answers were grouped under "yes" and neutral, disagree and strongly disagree options were grouped under "no." The

questionnaire was designed by the authors and was validated by the chief of the Diabetic Centre of the Al Hasa region.

The participants were requested to complete the answers without consulting materials, textbooks or fellow staffs. They were given 45 min to do so. The answered questionnaires were then returned to the principal investigators directly. The data were entered into the personal computer using SPSS, Version 18. Descriptive statistics for all variables was performed after scrutinizing the data. A *P*-value of <0.05 was considered as statistically significant.

Results

Basic characteristics of the study participants

A total of 122 GPs were distributed the questionnaires, and 99 physicians returned the questionnaires after proper answering. Fifteen physicians did not return the questionnaires while eight physicians refused, giving a response rate of 82%. The number of male physicians was much higher than that of female physicians: 72 (72.73%) and 27 (27.27%), respectively [Table 1]. The same was true with the non-Saudi physicians, who comprised (*n* = 76) 76.8% of the study population. The average age was 39.71 ± 8.02 years (range, 27–62 years) and the mean duration of clinical practice was 9 ± 0.619 years (range, 1–25 years). More than 75% of the physicians were in practice since <10 years. An average of 25 patients was seen by each GP every day, with most of them (77%) working in the practice area of more than 10,000 population. All these general practitioners were Ministry of Health employed, with 40 (40.4%) practicing in the rural area and 59 (59.6%)

practicing in the urban area. The source of information of the GPs on diabetes management was the CPG (15.2%), scientific meeting (12.1%), educational programme (19.2%) and medical journals (2%). 51.5% of the physicians reported that they were getting information for promotion of their KAP by combination of CPG, scientific meeting and educational programmes.

Diabetic-related KAPs of the GPs

The mean of the overall KAP score for all the respondents was 66.59 ± 8.8 (maximum, 100). The knowledge score was 35.76 ± 4.7 (maximum, 46), attitude score was 13.60 ± 4.7 (maximum, 30) and practice score was 17.56 ± 4.9 (maximum, 24). Table 2 shows the mean total score by sex, nationality, geographical area of practice and years of experience.

The mean overall KAP score for female physicians (64.67, *P* = 0.018) was lower than that of the male physicians (66.90, *P* = 0.018). The same was true with the Saudi physicians whose KAP score was 62.53 ± 9.6, *P* = 0.007, as compared with the non-Saudi physicians, with an overall score of 67.44 ± 8.6, *P* = 0.007. Overall, the KAP score of the rural physician was significantly higher (68.65 ± 10.2, *P* = 0.003) than the score by the urban physicians (65.34 ± 7.36, *P* = 0.003). The analysis also showed that the rural physicians scored better than the urban physicians in all the three segments, i.e.

knowledge, attitude and practice (*P* < 0.005). The overall KAP score among the GPs with 1–5 years of experience was 70.16, which was significantly higher than in those with a practice duration of 6–10 years (66.52, *P* ≤ 0.05) and those with a practice duration of 11–20 years (62.68, *P* ≤ 0.05). This difference was also found in all the segments of KAP. The overall KAP score of those GPs who had the CPG in their clinic was 70.90 ± 10.9, which was higher than KAP score of those GPs who did not have a copy of the CPG (65.10 ± 7.0). The most significant difference was in the practice score, where physicians who had CPG in their clinic scored significantly higher than those GPs who did not have CPG in their clinic (20.57 ± 7.54 vs. 16.55 ± 7.34, *P* < 0.003).

Response to the questions asked in the knowledge section

Table 3 presents response to physicians' knowledge questions regarding type 2 DM and its management. Most of the physicians (*n* = 78, 78.8%) were not aware of the prevalence of DM in Saudi Arabia. 71.7% (*n* = 71) of the physicians knew the correct definition of type 2 DM as laid down by the American Association of Diabetes. Almost all of the participating physicians (99%) correctly answered the clinical features of diabetes, but 76.34% (*n* = 76) of the physicians did not know the suggested level

Table 1: Demographic data of the physicians

Demographic characteristics	N	%
Gender		
Male	72	72.73
Female	27	27.27
Nationality		
Saudi	23	23.2
Non-Saudi	76	76.8
Area of practice		
Rural	40	40.4
Urban	59	59.6
Duration of practice		
1–5 years	25	25.25
6–10 years	50	50.51
11–20 years	21	21.21
>20 years	3	3.03
Practice size		
<5,000	2	2.02
5,000–10,000	16	16.16
10,001–15,000	33	33.33
15,001–20,000	42	42.43
>20,000	6	6.06

Table 2: Knowledge, attitude and practice scores for general practitioner by sex, nationality, geographical area and years of practice

Variable	No.	Mean (SD)			
		Knowledge (Maximum 46)	Attitude (Maximum 30)	Practice (Maximum 24)	Total (Maximum 100)
Sex					
Male	70	35.60 (4.43)	13.81 (5.05)	17.61 (5.27)	66.90 (10.20)
Female	29	35.15 (5.12)	13.04 (3.77)	17.04 (4.16)	64.67 (8.56)
		<i>P</i> = 0.021	<i>P</i> = 0.082	<i>P</i> = 0.023	<i>P</i> = 0.018
Nationality					
Saudi	23	33.75 (4.79)	12.78 (5.15)	16.00 (5.39)	62.53 (6.03)
Non-Saudi	76	36.62 (4.98)	13.40 (4.78)	17.42 (4.60)	65.44 (8.33)
		<i>P</i> = 0.000	<i>P</i> = 0.007	<i>P</i> = 0.005	<i>P</i> = 0.007
Geographical area					
Rural GP	40	35.95 (4.804)	14.05 (4.389)	18.65 (5.77)	68.69 (10.19)
Urban GP	59	35.25 (4.69)	13.25 (4.99)	16.84 (4.22)	64.68 (7.359)
		<i>P</i> < 0.025	<i>P</i> = 0.035	<i>P</i> = 0.003	<i>P</i> = 0.003
Years of practice					
1–5 years	25	36.32 (4.02)	14.72 (4.19)	19.12 (4.90)	71.68 (8.99)
6–10 years	50	35.68 (4.98)	13.40 (4.78)	17.44 (4.60)	65.44 (8.33)
11–20 years	21	33.90 (4.79)	12.78 (5.15)	16.00 (5.39)	62.76 (8.03)
>20 years	3	38.00 (2.30)	13.33 (6.11)	12.67 (2.30)	60.67 (4.16)
		<i>P</i> < 0.05	<i>P</i> < 0.05	<i>P</i> = 0.03	<i>P</i> < 0.05
CPG					
GP who had CPG	41	35.45 (4.804)	14.88 (4.62)	20.57 (7.54)	68 (10.93)
GP who did not have	58	34.45 (4.87)	14.10 (4.62)	16.55 (7.34)	65.10 (7.01)
		<i>P</i> = 0.033	<i>P</i> < 0.005	<i>P</i> = 0.003	<i>P</i> = 0.005

Table 3: No./percentage of correct knowledge of epidemiology, diagnosis and treatment of type 2 diabetes mellitus among the primary health care physicians

Statement	No.	Percentage
Prevalence of type 2 diabetes in Saudi Arabia	21	21.21
Diagnostic criteria of type 2 diabetes	71	71.71
Clinical features of type 2 diabetes	99	100
Suggested level of Hb1Ac and capillary plasma glucose level in the control of diabetes	26	26.26
Symptoms of diabetes mellitus	99	100
Clinical features of hypoglycemia	99	100
Clinical features of hyperglycemia	99	100
Causes of type 2 diabetes	99	100
Risk factors of diabetes	99	100
Treatment of newly diagnosed type 2 diabetic patients with oral hypoglycemic immediately	17	17.17
Lifestyle modification as the first step in the treatment of obese adult-onset diabetes	97	97.97
At least 150 min/week of moderate-intensity aerobic physical exercise needed for diabetic patient	84	84.84
Lifestyle modification + Metformin (MNT) therapy as the first step in a newly diagnosed obese adult-onset diabetic	84	84.84
Dose increase as the next step in the control of diabetes	86	86.86
Drug alteration as the next step in the control of diabetes	86	86.86
Start twice-daily insulin therapy in case of secondary failure to oral hypoglycemic drugs	59	59.59
Add bed time long-acting insulin in case of uncontrolled diabetes with maximum oral hypoglycemic drug therapy	74	74.74
Metformin as a combination therapy with insulin	75	75.75
Stop Metformin at serum creatinine level above 1.5 mg%	74	74.74
Treatment goal in a diabetic patient for microvascular disease prevention should be the A1C <7%	85	85.85
Diabetic Self Management Education (DSME) is an essential part of diabetic care	13	13.13
Self-monitoring of blood or urine glucose improves control	88	88.88
Omit sulphonylureas after the start of insulin to prevent hypoglycemia	63	63.63

of Hb1AC in controlled diabetes. Regarding knowledge about type 2 diabetes management, 17.17% ($n = 17$) of the physicians agreed that treatment with oral hypoglycemics should be started immediately in newly diagnosed type 2 diabetic patients while 82.8% ($n = 82$) disagreed. 97.7% ($n = 97$) of the physicians strongly agreed that lifestyle modification should be the first step in the treatment of obese adult-onset diabetes, while 84.8% ($n = 84$) of the physicians considered lifestyle modification + Metformin as the first-step treatment of the newly diagnosed obese adult-onset diabetes. As far as the intensity of exercise in the management of type 2 diabetes is concerned, 84.8% ($n = 84$) of the physicians correctly answered that at least 150 min/week moderate-intensity aerobic physical exercise is needed. 86.86% ($n = 86$) of the physicians agreed that in case of uncontrolled diabetes with single-drug treatment, the next step should be the increase of the dose of the same hypoglycemic drug. Regarding the insulin therapy in type 2 diabetic patients, more than 59.6% ($n = 59$) of the physicians agreed with twice-daily insulin therapy in case of secondary failure to oral hypoglycemic drugs and 74.7% ($n = 74$) of the physicians considered bed time addition of long-acting insulin in case of uncontrolled diabetes with maximum oral hypoglycemic drug therapy as the best option. 63.6% ($n = 63$) of the physicians agreed to avoid sulphonylureas after the start of insulin to prevent hypoglycemia. Metformin as a combination therapy with insulin was considered appropriate by 75.8% ($n = 75$) of the physicians, and 74% ($n = 74$) of the physicians correctly knew that Metformin should be discontinued at serum creatinine levels above 1.5mg%. Most of the physicians, 86.8% ($n = 86$), did not agree that Diabetic Self Management Education (DSME) is an essential part of diabetic care.

Responses to the questions asked in the attitude section

Regarding attitude toward type 2 diabetic patients and their

management, more than 90% of the physicians agreed that DM is an important Public Health Problem and primary prevention is the desired means to control it [Table 4]. However, only 23.2% of them considered that they are professionally well prepared to manage type 2 diabetes on diagnosis for the initiation of therapy, and 64% of them preferred to refer to a diabetologist for this. As far as the availability of CPG issued by the Ministry of Health is concerned, 58.6% ($n = 58$) of the physicians reported that they did not have the CPG in their clinic and 90.90% ($n = 90$) of those who had the CPG in their clinic found it to be

helpful in the management and follow-up of diabetic patients and believed that it should be used in daily practice. Only 43% of the physicians disagree with the fact that uneducated people have a greater prevalence of type 2 DM than the educated people, and 76.8% of the physicians blamed obesity as the cause of diabetes. As far as the complications of diabetes are concerned, more than 50% of the physicians did not agree with the fact that there is no need to worry about diabetic complications once diabetes is controlled.

Responses to the questions asked in the practice section

Tables 5a and 5b summarize the primary physicians' practice for paraclinical tests and follow-up clinical examinations in Type 2 diabetes management. Checking patients' ability to manage their diabetes, checking blood pressure, eye exam, lipids (low-density lipoprotein, high-density lipoprotein, serum cholesterol and triglycerides), serum creatinine, baseline electrocardiogram, chest X-ray and serum electrolyte (Na, K) were the best followed tests and examinations while foot exam and urinary protein were performed more often than recommended in the guideline. Serum HbA1C was the most delayed test. Regarding the technique of insulin injection, only 37.37% of the physicians appeared to know the correct angle of insulin injection, i.e. 90° [Table 5b]. When

Table 4: Evaluation of primary health care physicians' attitude on type 2 diabetes management

Statement	Response in no./percentage		
	Agree No. (%)	Neutral No. (%)	Disagree No. (%)
DM is an important public health problem	91 (91.91)	3 (3.03)	5 (5.06)
Believe in primary prevention of DM	90 (90.91)	9 (9.09)	0 (0.0)
All newly diagnosed type 2 diabetes should be referred to the diabetologist for initiation of therapy	64 (64.64)	11 (11.11)	23 (23.23)
As long as the diabetes is kept under control, there is no need to worry about diabetic complications	30 (30.31)	16 (16.16)	53 (53.53)
Do you believe in nondrug treatment of DM?	90 (90.91)	9 (9.09)	0 (0.0)
DM is caused by obesity	76 (76.77)	14 (14.14)	9 (9.09)
More uneducated people have diabetes than those who are educated	43 (43.43)	13 (13.14)	43 (43.43)
CPG is applicable to the management of diabetic cases	90 (90.91)	4 (4.04)	5 (5.05)
CPG should be used in daily practice	90 (90.91)	4 (4.04)	5 (5.05)
Do you believe that the guidelines should be implemented?	90 (90.91)	4 (4.04)	5 (5.05)
Does CPG help in the management of diabetes?	90 (90.91)	4 (4.04)	5 (5.05)

Table 5a: Physicians' practice on the necessity of paraclinical tests in the treatment of type 2 diabetes

Medical examination and paramedical clinical tests	On time % (no.)	More often % (no.)	Delayed % (no.)	Never % (no.)
Checking symptoms/complications	49.49 (49)	0.0 (0)	50.51 (50)	0.0 (0)
Checking patients' ability to manage their diabetes	75.76 (75)	0.0 (0)	24.24 (24)	0.0 (0)
Checking blood pressure	80.81 (80)	0.0 (0)	19.19 (19)	0.0 (0)
Foot exam	27.27 (27)	62.62 (62)	10.11 (10)	0.0 (0)
Eye exam	80.81 (80)	19.19 (19)	0.0 (0)	0.0 (0)
HbA1c	19.19 (19)	2.02 (2)	78.79 (78)	0.0 (0)
Lipids (LDL HDL, serum cholesterol and TG)	70.70 (70)	29.30 (29)	0.0 (0)	0.0 (0)
Urinary protein	20.20 (20)	78.79 (78)	0.0 (0)	1.01 (1)
Serum creatinine	78.79 (78)	21.21 (21)	0.0 (0)	0.0 (0)
Baseline ECG	87.88 (87)	11.11 (11)	0.0 (0)	1.01 (1)
Chest X-ray	75.76 (75)	4.04 (4)	0.0 (0)	20.20 (20)
Serum electrolyte (Na ⁺ , K ⁺)	67.68 (67)	19.19 (19)	0.0 (0)	13.13 (13)
Checking weight and BMI	58.58 (58)	0.0 (0)	38.38 (38)	3.04 (3)

Table 5b: No./percentage of correct answers to questions related to physicians' practice

Question	Options	Answer percentage, no.
Insulin should be injected at an angle of	90 degree	37.37, 37
	45 degree	56.57, 56
	60 degree	4.04, 4
	75 degree	2.02, 2
Which antihypertensive agent is the drug of choice in diabetic patients?	Beta blocker	1.0, 1
	Diuretic	2.02, 2
	ACE inhibitor	94.94, 94
	Angiotensin receptor blocker	2.02, 2

asked about the drug of choice of anti-hypertensive agent in diabetic patients, 94.9% of the physicians answered correctly, which was ACE inhibitor, while 5% of the physicians did not know the correct option [Table 5b].

Discussion

Type 2 diabetes is a major public health problem worldwide. In this study, we aimed to answer the main question: "Do the General physicians working at different Ministry of Health Primary Health Care centers know enough about Type 2 Diabetes and do they have the right attitude and practice towards it?" The present study also assessed whether the general physicians were aware of and familiar with the recommendations made in the CPG provided by the Ministry of Health.

The study results revealed a high response rate, with 99 out of 122 (82%) answering the questionnaire. The mean of the overall KAP score for all the respondents was 66.59 ± 8.826 (maximum, 100), an accepted standard for the evaluation of GPs. A similar study performed in Pakistan has found the highest KAP score of 65% among the family physicians.^[5] However, in the present study, most of the physicians were not aware of the prevalence of diabetes in Saudi Arabia, and more than 25% did not know the diagnostic criteria of Type 2 diabetes. Given the increasing prevalence of diabetes in Saudi Arabia and the evidence that type 2 diabetes is mostly

diagnosed at PHC, it is mandatory for all the GPs to know the correct diagnostic criteria as laid down by the American Diabetic Association. The KAP score of female GPs was significantly lower than that of the male GPs, and the same was true with the Saudi physicians as compared with the non-Saudi physicians. Overall, the KAP score of rural GPs was higher than that of GPs practicing in urban areas, which was statistically significant ($P = 0.003$). The same result was obtained in a similar study conducted in Pakistan, but the result was not statistically significant ($P = 0.2$).^[5] The higher KAP of the rural GPs may be due to the fact that, in the rural area, the GPs work in isolation and cannot easily contact the specialist for an expert opinion. It is likely that they update their knowledge on their own than the urban GPs. DSME is considered as an important programme to improve glycemic control among adults with type 2 diabetes.^[6] According to one other survey, it has been found that DSME helps the patients in seeking recommended medical care and engaging in daily self-care

activities. Patients with diabetes are two-times more likely to get all of their recommended medical care in a single year.^[7] DSME has also been proved to be an effective way of changing the key illness beliefs that predict quality of life and metabolic control at 3-months follow-up among diabetic patients.^[14] In our study, most of the GPs disagreed with this and did not consider it as an essential part of diabetic care. This may be due to a lack of knowledge among them about DSME.

Physicians' improper attitude toward treating diabetic patients can be one of the barriers for proper diabetic management. Although a majority of the GPs in this study realized that DM is a major public health problem and believed in the primary prevention of DM, but, at the same time, most of them found themselves not effective in the initial management of diabetes and preferred to refer all the newly diagnosed diabetic cases to the diabetologist for initiation of therapy. The results of studies on the physician's attitude has shown that primary care physicians consider diabetes more difficult to treat than other chronic diseases because of the frequent monitoring and medication adjustment to achieve the treatment goals.^[8] As far as the CPG is concerned, the KAP score of those GPs who had the CPG in their clinic was higher than the KAP score of those GPs who did not have a copy of the CPG ($P < 0.005$), and was more significant in the practice segment of the KAP score. This showed that the CPG has a positive effect on GPs' behavior while dealing with diabetic patients. The same was not true in one study conducted in Estonia, where doctors' knowledge and behavior in the treatment of type 2 diabetes was unrelated to the availability of CPG.^[9] Likewise, there are many studies that have shown that mere availability of CPG did not improve the KAP of the GPs in the management of type 2 diabetes.^[10-11] The most important factor is physician's adherence to the CPG. However, it must be assured that CPG is made available to each GP clinic, only after which can its effect on the behavior of the GP be evaluated. It's worth mentioning here that more than 50% of the GPs in the present study reported that they did not have the CPG in their clinic.

Regarding KAP score with the clinical experience, it was interesting to note that KAP score decreased with more experience. The KAP of GPs with 1–5 years was significantly higher than that in those with more experience. This may be due to the fact that the young GPs are more conversant with recent approaches regarding diagnosis and treatment of diabetes, which may be lacking among the senior GPs.

Diabetes is a life-long disease and leads to early multi-organ damage if not controlled. Monitoring the diabetic cases by regular examinations and investigations requires a good practice strategy of the GPs. We found in our study that a majority of the GPs were following most of the recommended routine investigations and examinations on time except HbA1c, which was delayed. The level of HbA1c provides a measure of the glycemic control of diabetic patients during the previous 2–3 months, and changes of its level at different points of time has certain implications on the diabetic complications; therefore, its routine measurement on time is important.^[13] Routine estimation of HbA1c was also poorly followed in one study performed in Estonia. But, in a similar study in the USA, it has been found that the performance of HbA1c was higher than 90%, and has increased compared with the early '90s.^[9] No availability of HbA1c test at the

primary healthcare level may be one factor as the physician may be reluctant to send the diabetic patients to the tertiary centers for this test. Performance of HbA1c is expected to improve in Saudi Arabia with the introduction of HbA1c estimation facilities at PHCs recently.

For the proper action, insulin must be injected at the correct angle as injecting too deep could deliver insulin into the muscle where it is absorbed too quickly.^[12] At the same time, if insulin is injected too shallow, it could be more painful and less absorbed. The fact that only 37.37% of the physicians in

our study knew the correct angle of insulin injection, i.e. 90° in normal adults and 45° in the case of thin adults, highlights the confusion persisting among the GPs in this region. One study performed in Pakistan also found the same confusion among the family physicians.^[5]

Conclusion

The role of primary healthcare physicians is pivotal in the management of type 2 diabetes. This study has explored several aspects of diabetes-related KAP of the Ministry of Health-appointed primary healthcare physicians. It has identified the need for improvement in their knowledge and practices for educating and treating the type 2 diabetic patients attending their clinics. It is thus recommended that awareness and education programme is necessary to update the GPs (especially those working in urban areas, females and Saudi physicians) on epidemiology, diagnostic criteria of type 2 diabetes, DSME, effective treatment of diabetes, practice of insulin injection, adherence to the CPG and prevention of the complications of type 2 diabetes. It is of paramount importance that CPG be made available to each physician.

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