

Knowledge, Attitude and Practice Regarding Diabetes among Saudi MOH Primary Healthcare Physicians in Jeddah: A Cross Sectional Study

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ABSTRACT

Background: Role of primary care physicians in management of diabetes mellitus is very essential. Their attitudes and practices are influenced by their knowledge; therefore, the importance of healthcare providers in promoting understanding and helpful attitudes about diabetes cannot be underestimated.

Objective: To assess the level of knowledge, attitude and practice of general physicians regarding diabetes in Jeddah city.

Subjects and Methods: A cross-sectional study was conducted throughout the period 1st June to 31st August 2018 among a representative sample of general practitioners working at Ministry of Health (MOH) primary health care centres in Jeddah city, Saudi Arabia. A structured self-administered questionnaire was used to collect data. It is comprised of four sections, starting with demographic information and clinical experience, 12 questions measuring the respondent's knowledge of diabetes diagnosis, treatment and complications, 9 questions evaluating physician's attitude towards diabetes control and 6 questions measuring the physician's practices toward their diabetic patients.

Results: The study included 171 physicians. Females represent 58.5% of them. Almost half of them (50.9%) aged between 30 and 39 years. Majority of the physicians (82.5%) were Saudis. Overall, the knowledge score percentage ranged between 8.33% and 100% with a mean of 69.7% and standard deviation of $\pm 9.4\%$. Female physicians ($p=0.007$), those working at diabetic clinics ($p<0.001$) and have seen between 51 and 100 patients/ week ($p = 0.005$) were more

knowledgeable. Overall, based on median level of the attitude score, more than half of the physicians (54.4%) had positive attitude towards DM and its control. Overall, the practice score percentage ranged between 0% and 100% with a mean of 67.3% and standard deviation of 22.8%. Physicians working at diabetic clinics ($p<0.001$) and those without history of DM among first degree relatives ($p=0.036$) expressed better practice than others.

Conclusion: General practitioners had fair knowledge regarding DM with deficiency in some important aspects. Their attitude towards diabetic control is quite acceptable. However, their practice regarding some important aspects was suboptimal.

Keywords: Knowledge, Attitude, Practice, Diabetes, Primary Healthcare, Physicians.

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INTRODUCTION

Diabetes Mellitus (DM) is a major chronic disease globally: it affected 425 million adults in 2017 and is expected to affect 629 million adults by 2045. Global comparative prevalence data of 2017 ranked Saudi Arabia as having the seventh highest prevalence of DM in the world (17.72%).¹

The most recent community based national non-communicable disease (NCD) survey by the Saudi Ministry of Health reports that the total prevalence of diabetes (ages 15 years and older) was 14.8 % for males and 11.7 % for females in 2013.² Prevalence

increased with age and ranged from 7.8% among those aged 25 to 34 to 50.4% among those aged 65 and older. Borderline diabetes was present in 17% (1.17 million) of men and 15.5% (0.95 million) of women. Among Saudi men, 1 million are diabetic, 583,000 are on medication for diabetes, and 230,000 have uncontrolled diabetes. For Saudi women, 720,000 are diabetic, 367,000 are on medication, while 167,000 have uncontrolled diabetes.² Diabetes cost the nation Saudi Arabian Riyal (SAR) 0.9 billion in 2010 and is estimated to cost SAR 6.5 billion by 2020.

This is an increase of SAR 5.6 billion or seven times higher cost than 2010 which will have a substantial economic burden on the Saudi health care system.³

Uncontrolled diabetes leads to increased risk for cardiac disease, stroke, blindness, kidney failure, leg amputation and early death.⁴ Improved glycemic control reduces the rate of complications and evidence suggests that patients, who are knowledgeable about DM self-care, have better long term glycemic control.⁵⁻⁸ Poor diabetes care is partly due to the prevalent, misguided attitudes in DM management and compliance of both health care providers and people with diabetes.⁴

Studies have also been conducted to assess barriers to compliance, impact and audit of structure, process and outcome of diabetic centers in Saudi Arabia.⁹ These studies targeted a single setting or a selected group or assessment of few of the complications. Limited studies have been conducted in Saudi Arabia on the knowledge, attitudes, and practices (KAP) of diabetic patients^{6,7} and physicians.⁸ No studies have been conducted in Jeddah city assessing the KAP of physician regarding DM.

Acknowledging that non-communicable disease is an important public health issue, the government established a separate Directorate for Non-Communicable Diseases in 2005, having Diabetes Control and Prevention Program (DCPP). In order to facilitate diabetic patients, separate mini clinics were established in the primary health care centers since 2010. The DCPP conducts training of health care providers, maintains a database of diabetic patients, reviews guidelines for DM management on a yearly basis and provides free glucometers to diabetic patients. A national NCD surveillance program of The WHO STEP wise approach to Surveillance (STEPS) is fully implemented in Saudi Arabia; however, it has limited focus on knowledge, attitude and practices which is vital for the diabetes control. Study of KAPs regarding diabetes management may provide government and health planner's information which could prove crucial for public health decision making.¹⁰ With the limited time and resources, study part of the country may provide baseline data that represent to national picture regarding DM management practice.

Nakar, Yitzhaki¹¹, reported that, doctors had low knowledge of criteria for starting insulin impact the success of DM management. Therefore, doctors scientific knowledge of DM, the physician' attitudes towards treatment of DM can influence patient outcomes. The beliefs of doctors have been found to be important to their success in treating diabetes.¹²

Moreover, the researchers found the doctors' attitude had an influence on patients and their willingness to accept insulin therapy. Where this attitude delayed starting insulin therapy, the consequences can be significant for the patient as their blood sugar remains uncontrolled.¹¹ The evidence suggests there is a direct relationship between the doctors' attitude towards diabetes care and the diabetic patient's knowledge and health care practices. For example, those patients who had been taught about foot care by their doctor, performed more effective self-examinations of their feet compare to other patients.^{13,14}

The role of preventive programmes to limit the burden of non-communicable diseases, such as diabetes, is at least equal to, or potentially greater than the role of treatment approaches.¹⁵ The attitudes and practices of individuals are influenced by knowledge; therefore, the importance of healthcare providers in promoting

understanding and helpful attitudes about diabetes cannot be underestimated. To encourage this, continuing medical education programmes (CME) represent an obvious means of achieving this goal.¹⁶

This study aimed to assess the level of knowledge, attitude and practice of general physicians regarding diabetes in Jeddah city, Kingdom of Saudi Arabia.

SUBJECTS AND METHODS

A cross-sectional study was carried out at Ministry of Health (MOH) primary health care centres in Jeddah city, Kingdom of Saudi Arabia 1st June 2018 to 31st August 2018 among general practitioners (GP). Medical and family medicine specialists who work in PHCs were excluded as they are experts in DM management.

Stratified random sampling technique was used. First, the population (n=248) was divided into the relevant primary healthcare centres (PHC) located in Jeddah city (n=48), these centres are linked to 5 major hospitals in the city namely: King Abdul-Aziz Hospital, East Jeddah General Hospital, King Fahd Hospital, El Thagher Hospital and finally King Abdullah Medical Complex. All strata were included, PHCs were selected based on these 5 major hospitals (strata) using the simple random sample method, then all GPs were draw from each PHC selected. This strategy has several advantages compared to other strategies; the randomisation of the participants make it better for generalisation of the finding of the study.¹⁷

The questionnaire was distributed personally by researcher to physicians at these PHCs. The participants were required to complete the questionnaire within 15 minutes without consulting materials, textbook, internet or other sources of help.

The study population included all the 248 GPs working at different MOH PHCs in Jeddah city. Epi info epidemiological software (version 3.5.4) C.D.C Atlanta USA) was used to calculate sample size, assuming that 80% of the physician will response to the questionnaire survey and in order to achieve 95% confidence interval level with error less than 5%, at least 181 physicians were needed.

A structured self-administered questionnaire was used to collect data from the primary healthcare physicians in Jeddah. The questionnaire was adopted from a study done among Iranian internists by Niroomand in 2017.¹⁸ The questionnaire is comprised of four sections, starting with demographic information and clinical experience. The second section included 12 questions measuring the respondent's knowledge of diabetes diagnosis, treatment and complications. The third section included 9 questions evaluating physician's attitude towards diabetes control. The final section explores the physician's practices toward their diabetic patients in clinic with 6 questions.

Knowledge and practice questions were in multiple choices format with a correct (scored as 1) and three wrong choices (scored as wrong 0). The knowledge score will range from 0–12 points. Knowledge score percentage was computed and used for comparisons. While, the practice score will range from 0–6 points. The total practice score percentage was computed and used for comparisons.

However, the nine statements of attitude were measured using a 5-point Likert scale (1=Strongly Disagree, 2=Disagree, 3=neither agree nor disagree, 4=Agree and 5=strongly agree). The total

score was computed and its median value was measured (it was 19). Physicians scored below the median value were considered having "negative attitude" whereas scored at or above the median value were considered having "positive attitude".

The questionnaire has a good content validity, which was assessed by a panel of eight diabetologist. The content validity index (CVI) and content validity ratio (CVR) was also calculated. The overall CVI and R-CVI, C-CVI, and S-CVI were 0.888, 0.882, 0.923, and 0.859, respectively (Niroomand. et. al, 2017). The internal consistency reliability of questionnaire was also good; Cronbach's alpha coefficient was 0.823 for the total instrument and 0.802, 0.791, and 0.845 for the KAP subscales, respectively.¹⁸

Ethical considerations were followed throughout the study conduction.

Statistical Analysis

The data for the study were analysed using SPSS (Statistical Packages for Social Sciences) version 25.0. Since, both of total knowledge and practice score percentages were abnormally distributed as evidenced by significant Kolmogorov-Smirnov test, non-parametric statistical tests were used for analysis. Mann-Whitney test was applied to compare between two groups whereas Kruskal-Wallis was applied to compare between more than two groups. Chi-square test (χ^2) was applied to test for the association between two categorical variables. P-value less than 0.05 was considered for statistical significance.

Table 1: Demographic and professional characteristics of the physicians

	Categories	Frequency (N=171)	Percentage
Gender	Male	100	58.5
	Female	71	41.5
Age (years)	<30	50	29.2
	30-39	87	50.9
	40-49	26	15.2
	>50	8	4.7
	Nationality	Saudi	141
	Non-Saudi	30	17.5
Experience (years)	1-5	73	42.7
	6-10	61	35.7
	11-20	27	15.8
	>20	10	5.8
	Work at diabetes clinic	Yes	82
No		89	52.0
Number of diabetic patients seen/week	<25	88	51.5
	25-50	49	28.7
	51-100	30	17.5
	>100	4	2.3
First degree relative with diabetes	Yes	101	59.1
	No	70	40.9

Table 2: Response of the physicians to knowledge questions regarding diabetes mellitus.

Questions	Response		
	Right answer	No.	%
1. Which one is a diabetes diagnostic criterion?	HbA1c \geq 6.5%	115	67.3
2. Which one is not a risk factor for type 2 diabetes?	Smoking	122	71.3
3. Which one is the best choice for initiation of treatment in newly diagnosed diabetic patients?	Metformin	150	87.7
4. Which one is not a sign of hypoglycemia?	Polydipsia	140	81.9
5. When we refer a diabetic patient for retinopathy evaluation?	Every year	139	81.3
6. Which one is the correct laboratory test for nephropathy screening?	ACR	72	42.1
7. Which one is the goal of treatment of type 2 diabetes?	All (FBS (100-125) mg/dl, HbA1c \leq 7% and 2 hour PPG (90-180 mg/dl)	108	63.2
8. Which one is the LDL goal for diabetic patients without cardiac problems?	<100 mg/dl	102	59.6
9. Which one is the correct goal of blood pressure in diabetic patients?	<140/90 mm Hg	101	59.1
10. Which one is not pre-diabetes?	HbA1C (6.5-7.5	95	55.6
11. Which one is the best choice for gestational diabetes?	Insulin	148	86.5
12. Which one is the best choice for diabetic patient with hypertension?	ACE inhibitors	139	81.3

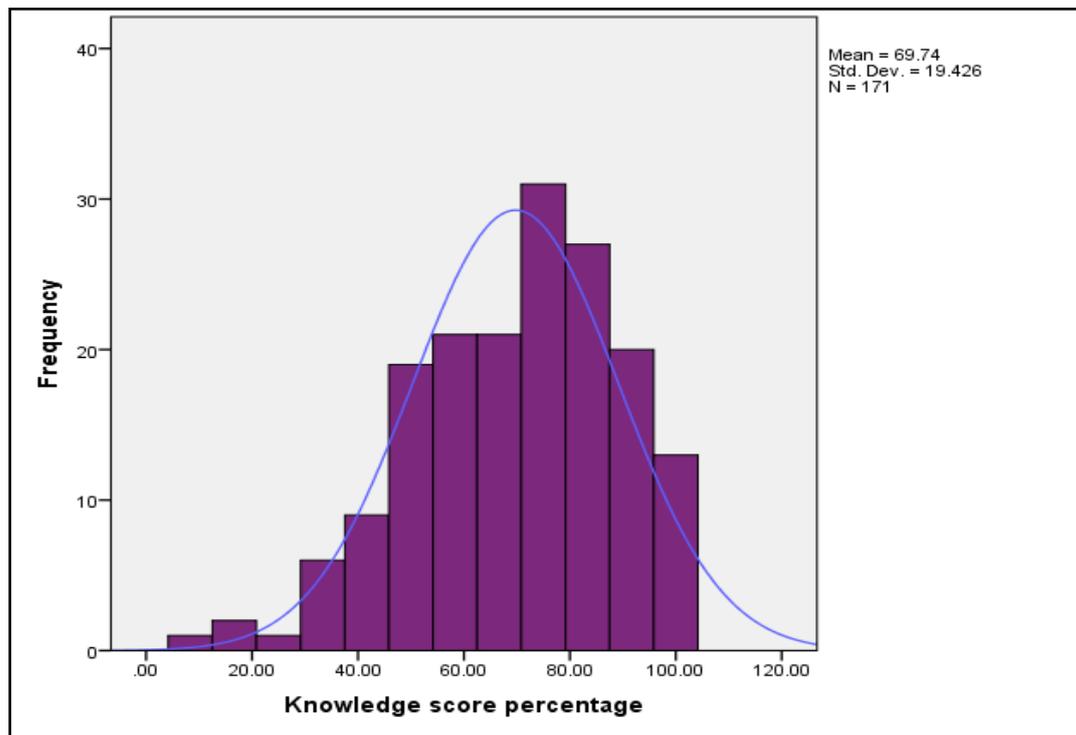


Figure 1: Distribution of the percentage of knowledge about diabetes score among the physicians.

Table 3: Factors associated with knowledge of the physicians regarding diabetes mellitus.

		Knowledge score percentage			p-value
		Median	IQR	Mean rank	
Gender	Male (n=100)	66.7	50-83.3	77.42	0.007*
	Female (n=71)	75	66.7-83.3	8.08	
Age (years)	<30 (n=50)	66.7	50-83.3	78.55	0.495**
	30-39 (n=87)	75	58.3-83.3	91.05	
	40-49 (n=26)	75	58.3-83.3	86.42	
	>50 (n=8)	66.7	45.8-83.3	76.25	
Nationality	Saudi (n=141)	75	58.3-83.3	88.29	0.186*
	Non-Saudi (n=30)	66.7	58.3-75	75.25	
Experience (years)	1-5 (n=73)	66.7	50-79.2	77.36	0.094**
	6-10 (n=61)	75	54.2-83.3	88.53	
	11-20 (n=27)	75	66.7-91.7	104.72	
	>20 (n=10)	75	54.2-83.3	83.10	
Work at diabetes clinic	Yes (n=82)	83.3	66.7-91.7	108.39	<0.001*
	No (n=89)	58.3	50-75	65.37	
Number of diabetic patients seen/week	25 (n=88)	66.7	50-83.3	73.95	0.005**
	25-50 (n=49)	75	66.7-83.3	97.26	
	51-100 (n=30)	83.3	58.3-91.7	104.93	
	>100 (n=4)	66.7	45.8-81.3	71.25	
History of first degree relatives with diabetes mellitus	Yes (n=101)	66.7	54.2-83.3	80.20	0.064*
	No (n=70)	75	58.3-85.4	94.36	

IQR: Inter-quartile range; *: Mann-Whitney test; **:Kruskal-Wallis test

RESULTS

The study included 171 physicians. Females represent 58.5% of them. Almost half of them (50.9%) aged between 30 and 39 years whereas 29.2% aged below 30 years. Majority of the physicians (82.5%) were Saudis. Seventy three physicians (42.7%) had an experience ranged between one and five years whereas 61 physicians (35.7%) had an experience between 6 and 10 years.

Slightly less than half of them (48%) worked at diabetic clinic. Slightly more than half of them (51.5%) have seen less than 25 diabetic patients per week. More than half (59.1%) of the physicians had first degree relative with history of diabetes mellitus. (Table 1) Table 2 summarizes the response of the physicians to knowledge questions regarding diabetes mellitus.

Majority of them could recognize that metformin is the best choice for initiation of treatment in newly diagnosed diabetic patients (87.7%), insulin is the best choice for gestational diabetes (86.5%), polydipsia is not a sign of hypoglycemia (81.9%), diabetic patient should be referred for retinopathy evaluation every year (81.3%) and ACE inhibitor is the best choice for diabetic patient with hypertension. On the other hand, less than half of them (42.1%) knew that ACR is the correct laboratory test for nephropathy screening.

Overall, the knowledge score percentage ranged between 8.33% and 100% with a mean of 69.7% and standard deviation of $\pm 9.4\%$ as illustrated in figure 1.

As demonstrated from table 3, female physicians were more knowledgeable than males regarding DM (mean ranks of knowledge score were 98.08 and 77.42, respectively). This difference was statistically significant, $p=0.007$. Physicians work at diabetic clinics had higher significant level of knowledge regarding DM than others (mean rank was 108.39 versus 65.37, $p<0.001$). Regarding number of patients seen/week, the highest level of knowledge was observed among physicians who have seen between 51 and 100 patients/week (mean rank was 104.93) whereas the lowest knowledge level was reported among physicians who have seen >100 patients/week (mean rank was 71.25) and 25 patients/week (mean rank was 73.95), $p=0.005$.

Other studied factors such as age, nationality, experience, and history of first degree relatives with diabetes mellitus were not significantly associated with physicians knowledge regarding DM. Majority of the physicians either strongly agreed or agreed that early treatment of diabetes could prevent complications (97.7%), regular exercise helps controlling diabetes (97.1%), controlling serum lipids and blood pressure are mandatory for prevention of

cardiovascular complications of diabetes (95.3%) and patients should receive sufficient explanation about diabetes, its complications, and how to prevent complications at each visit (84.2%). On the other hand, 51.5% of physicians either strongly agreed or agreed that carbohydrates should be omitted from diet of overweight diabetic patients, diabetes reduce the patients' life span (50.3%) and in diabetic retinopathy, moderate aerobic exercises are forbidden (27.5%). (Table 4)

Overall, based on median level of the attitude score, more than half of the physicians (54.4%) had positive attitude towards DM and its control as seen in figure 2. As realized from table 5, none of the studied characteristics of physicians (age, gender, nationality, experience, work at diabetic clinic, number of diabetic patients seen/week and history of first degree relatives with diabetes mellitus) was significantly associated with physicians' attitude towards diabetes and its control.

Table 6 summarizes the responses of the general practitioners to questions regarding their practice of DM management. Majority of them (84.2%) reported that the best choice for controlling dyslipidemia in diabetic patient is Atorvastatin. Also, majority of them (81.9%) check HbA1c for diabetic patients 4 times a year. Most of them (71.3%) do not refer a diabetic patient to the ophthalmologist in case of presence of any itching. About two-thirds of the physicians (62.6%) suggested high fiber, slow release carbohydrates for diet of a diabetic patient with BMI of 28 kg/m². More than half of the physicians (55%) check lipid profile for diabetic patients once a year and almost half of them (49.1%) examine the foot of diabetic patients once a year.

Overall, the practice score percentage ranged between 0% and 100% with a mean of 67.3% and standard deviation of 22.8%. (Figure 3)

Table 4: Attitude of the physicians towards diabetes mellitus and its control

Statement	Response					Weighted mean \pm SD
	Strongly Agree N (%)	Agree N (%)	Neutral N (%)	Disagree N (%)	Strongly disagree N (%)	
▪ Early treatment of diabetes could prevent complications.	137 (80.2)	30 (17.5)	4 (2.3)	0 (0.0)	0 (0.0)	4.78 \pm 0.47
▪ In diabetic retinopathy moderate aerobic exercises are forbidden.	28 (16.4)	19 (11.1)	32 (18.7)	63 (36.8)	29 (17.0)	2.73 \pm 1.32
▪ All diabetic patients should be visited by a diabetologist each 3 month.	68 (39.8)	57 (33.3)	20 (11.7)	17 (9.9)	9 (5.3)	3.92 \pm 1.18
▪ Patients should receive sufficient explanation about diabetes, its complications, and how to prevent complications at each visit.	103 (60.2)	41 (24.0)	18 (10.5)	8 (4.7)	1 (0.6)	4.39 \pm 0.90
▪ Diabetes reduces the patients' quality of life.	57 (33.3)	44 (25.7)	27 (15.8)	28 (16.4)	15 (8.8)	3.58 \pm 1.33
▪ Diabetes reduces the patients' life span.	45 (26.3)	41 (24.0)	35 (20.4)	34 (19.9)	16 (9.4)	3.38 \pm 1.32
▪ Regular exercise helps controlling diabetes.	138 (80.7)	28 (16.4)	4 (2.3)	1 (0.6)	0 (0.0)	4.77 \pm 0.51
▪ Carbohydrates should be omitted from diet of overweight diabetic patients.	41 (24.0)	47 (27.5)	19 (11.1)	43 (25.1)	21 (12.3)	3.26 \pm 1.39
▪ Controlling serum lipids and blood pressure are mandatory for prevention of cardiovascular complications of diabetes.	131 (76.6)	32 (18.7)	7 (4.1)	0 (0.0)	1 (0.6)	4.71 \pm 0.60

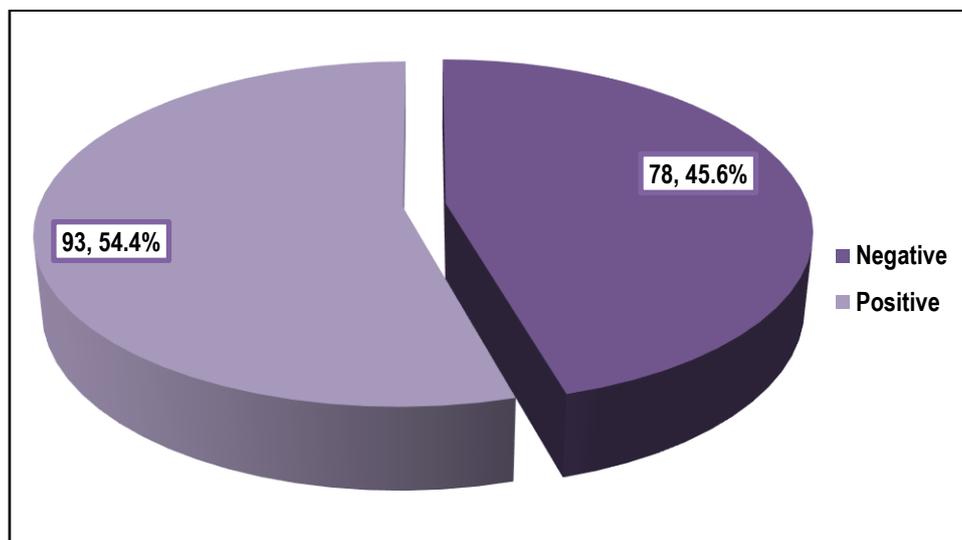


Figure 2: Attitude of the physicians towards diabetes mellitus and its control.

Table 5: Factors associated with attitude of the physicians towards diabetes mellitus and its control.

		Attitude towards diabetes		p-value*
		Negative N=78 N (%)	Positive N=93 N (%)	
Gender	Male (n=100)	47 (47.0)	53 (53.0)	0.666
	Female (n=71)	31 (43.7)	40 (56.3)	
Age (years)	<30 (n=50)	20 (40.0)	30 (60.0)	0.303
	30-39 (n=87)	39 (44.8)	48 (55.2)	
	40-49 (n=26)	13 (50.0)	13 (50.0)	
	>50 (n=8)	6 (75.0)	2 (25.0)	
Nationality	Saudi (n=141)	66 (46.8)	75 (53.2)	0.497
	Non-Saudi (n=30)	12 (40.0)	18 (60.0)	
Experience (years)	1-5 (n=73)	29 (39.7)	44 (60.3)	0.402
	6-10 (n=61)	28 (45.9)	33 (54.1)	
	11-20 (n=27)	15 (55.6)	12 (44.4)	
	>20 (n=10)	6 (60.0)	4 (40.0)	
Work at diabetes clinic	Yes (n=82)	34 (41.5)	48 (58.5)	0.296
	No (n=89)	44 (49.4)	45 (50.6)	
Number of diabetic patients seen/week	25 (n=88)	41 (46.6)	47 (53.4)	0.076
	25-50 (n=49)	17 (34.7)	32 (65.3)	
	51-100 (n=30)	19 (63.3)	11 (36.7)	
	>100 (n=4)	1 (25.0)	3 (75.0)	
History of first degree relatives with diabetes mellitus	Yes (n=101)	43 (42.6)	58 (57.4)	0.338
	No (n=70)	35 (50.0)	35 (50.0)	

* Chi-square test

Table 6: Practice of the physicians regarding diabetes mellitus management

Questions	Response		
	Right answer	No.	%
1. When do you not refer a diabetic patient to the ophthalmologist?	Any itching	122	71.3
2. How many times a year does you check HbA1c for diabetic patients?	4 times	140	81.9
3. How many times a year does you check lipid profile for diabetic patients?	One time	94	55.0
4. Which one is the best choice for controlling dyslipidemia in diabetic patient?	Atorvastatin	144	84.2
5. How many times a year does you examine the foot of diabetic patients?	One time	84	49.1
6. Which one is your suggestion for diet of a diabetic patient with BMI of 28 kg/m ² ?	High fiber, slow release carbohydrates	107	62.6

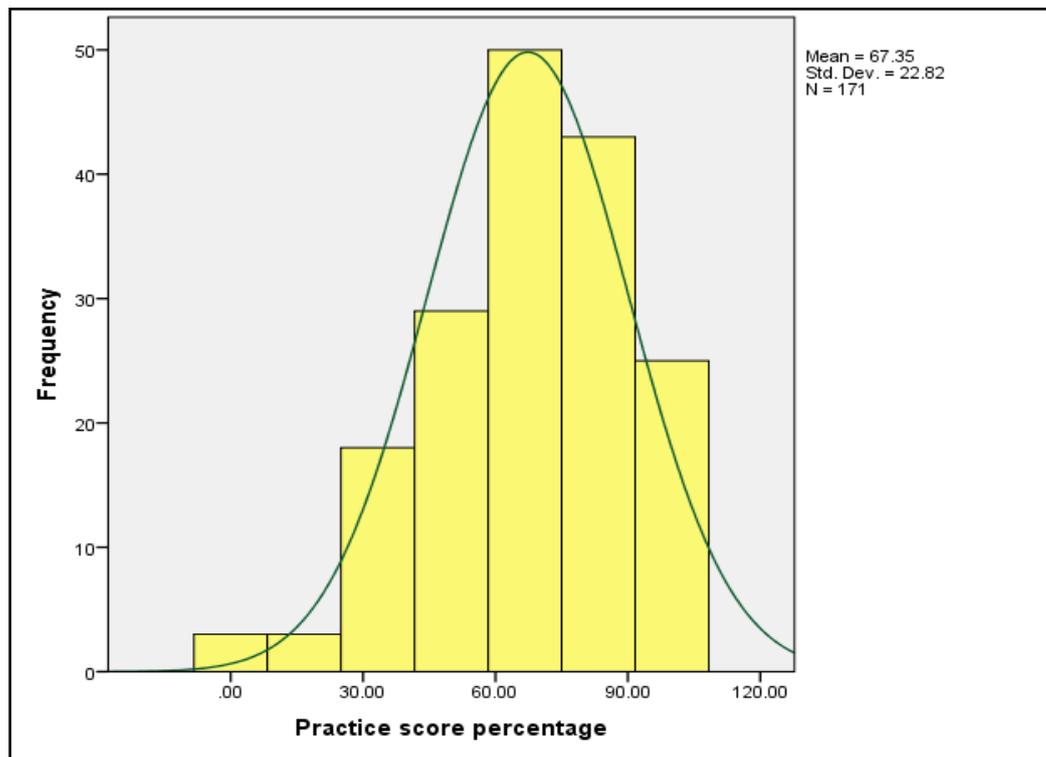


Figure 3: Distribution of the percentage of practice of diabetes score among the physicians.

Table 7: Factors associated with practice of the physicians regarding diabetes mellitus management.

		Practice score percentage			p-value
		Median	IQR	Mean rank	
Gender	Male (n=100)	66.7	50-83.3	83.17	0.362*
	Female (n=71)	66.7	50-83.3	89.99	
Age (years)	<30 (n=50)	66.7	50-83.3	80.52	0.069**
	30-39 (n=87)	66.7	50-83.3	92.20	
	40-49 (n=26)	66.7	50-83.3	87.50	
	>50 (n=8)	50	37.5-66.7	47.94	
Nationality	Saudi (n=141)	66.7	50-83.3	85.43	0.736*
	Non-Saudi (n=30)	66.7	66.7-83.3	88.70	
Experience (years)	1-5 (n=73)	66.7	50-83.3	83.27	0.257**
	6-10 (n=61)	66.7	50-83.3	87.94	
	11-20 (n=27)	83.3	50-83.3	97.39	
	>20 (n=10)	58.3	45.8-70.8	63.35	
Work at diabetes clinic	Yes (n=82)	83.3	66.7-83.3	101.98	<0.001*
	No (n=89)	66.7	50-83.3	71.28	
Number of diabetic patients seen/week	25 (n=88)	66.7	50-83.3	77.21	0.067**
	25-50 (n=49)	83.3	58.3-83.3	95.97	
	51-100 (n=30)	75	50-87.5	97.58	
	>100 (n=4)	58.3	50-79.2	70.38	
History of first degree relatives with diabetes mellitus	Yes (n=101)	66.7	50-83.3	79.55	0.036*
	No (n=70)	66.7	50-87.5	95.30	

IQR: Inter-quartile range; *: Mann-Whitney test; **:Kruskal-Wallis test

From table 7, it is evident that physicians work at diabetic clinics had higher percentage of score regarding practice of diabetes management compared to those working at general clinics (mean ranks were 101.98 and 71.28, respectively). This difference was statistically significant, $p < 0.001$. Physicians with a history of first degree relatives with diabetes mellitus had lower practice score of

DM management compared to those without such history (mean rank was 95.30 versus 79.55), $p = 0.036$.

Other studied factors (gender, age, nationality, experience and number of diabetic patients seen per week) were not significantly associated with practice of DM management among general practitioners.

DISCUSSION

General practitioners can have an essential role concerning the care and education of diabetic patients.¹⁹ In addition, their attitude towards diabetes mellitus and its control is important in their success for proper management of diabetes and providing protection from its chronic complications.^{20,21} Because of these facts, this study was conducted to evaluate knowledge, attitude and practice of general practitioners in Jeddah city, Saudi Arabia regarding diabetes mellitus and its management.

Metformin is the first line of choice for management of newly diagnosed type 2 diabetic cases as it has a large safety margin.²² In case of gestational diabetes, if diet modification, which is the first line of therapy, fails, insulin therapy is indicated.²³ In the present study, majority of the GPs could recognize that metformin is the best choice for initiation of treatment in newly diagnosed diabetic patients and insulin is the best choice for gestational diabetes.

In accordance with findings of other studies^{24,25}, majority of GPs in this study could recognize that diabetic patient should be referred for retinopathy evaluation every year.

In agreement with Chwalow et al²⁴, the present study revealed that majority of the physicians knew that ACE inhibitor is the best choice for diabetic patient with hypertension. However, deficient knowledge was observed regarding some issue as only 42.1% of them knew that ACR is the correct laboratory test for nephropathy screening. In another study carried out in Iran among internists, the deficient knowledge was observed regarding the optimal blood pressure in patients with diabetes and the frequency of diabetic foot examination.¹⁸

Overall, in the present study, the knowledge score percentage regarding DM ranged between 8.3% and 100% with a mean of 69.7% and standard deviation of $\pm 9.4\%$. In another Saudi study carried out in Al Hasa (2010)⁸, the mean of the overall knowledge percentage score was $66.6 \pm 8.8\%$. In a study carried out among internists in Iran, 66.3% of the optimal knowledge level has been reported.¹⁸

In the present study, female physicians were more knowledgeable regarding DM compared to males with no difference between them concerning attitude and practice. In Iran, physicians' gender had no significant impact on diabetes KAP.¹⁸

The current study revealed no impact of physicians' age on their KAP concerning DM. Similarly, physicians' experience since graduation had no influence on DM KAP. This finding indicates the need for continuous education for physicians and evaluation of their diabetes care skills. In a study carried out among internists in Iran, the physicians' KAP were decreased by increasing in age and experience.¹⁸ Also, in a study carried out in Al Hasa, KSA, the knowledge and practice regarding DM decreased with increase in experience.⁸ This may be attributed to the fact that young physicians are more oriented with recent guidelines regarding diagnosis and treatment of diabetes, which may be lacking among the senior physician. This again necessitates updating of the GPs with recent guidelines through effective continuous medical education. In Pakistan, Shera et al.²⁶ reported positive influence of family physicians' experience on knowledge and attitude regarding diabetes management.

In the current study, physicians who work in diabetic clinics expressed better knowledge and practice regarding diabetes. However, no change has been observed concerning attitude. In

Iran¹⁸, internists who work in teaching hospitals had a significantly higher attitude than those who work in other settings. This finding may indicate that at diabetic clinics, there are more facilities for physicians to update their knowledge regarding DM such as clinical guidelines and educational activities.

In this study, physicians who have seen between 51 and 100 diabetic patients per week expressed the highest knowledge level regarding DM. number of diabetic patients seen was not significantly associated with physicians' attitude or practice concerning DM. In a previous study in Nigeria, physicians who have seen more than 50 patients a month had a higher level of knowledge.²⁷

In agreement with other studies carried out in Taif²⁵ and Al Hasa⁸, KSA, majority of the general practitioners considered early detection of diabetes and proper management of its complications are essential to prevent serious complications. This also agrees with findings of other overseas studies.^{24,26,28}

In agreement with Niroomand et al¹⁸, the least greed upon attitude statement was regarding the aerobic exercise in patients with diabetic retinopathy.

It has been concluded from previous studies that primary care physicians consider treatment of DM more difficult than other chronic diseases because of the need for frequent monitoring and medication adjustment to achieve the needed goals.²⁹ In the present study, most of the GPs agreed that all diabetic patients should be visited by a diabetologist each 3 month.

Vinker et al concluded that physicians must be oriented with the diabetic care guidelines.²⁸ In the present study, majority of the general practitioners used Atorvastatin as the best choice for controlling dyslipidemia, and checked HbA1c for diabetic patients 4 times a year. About two-thirds of them suggested high fiber, slow release carbohydrates for diet of a diabetic patient with BMI of 28 kg/m². Slightly more than half of the physicians checked lipid profile for diabetic patients once a year and almost half of them examine the foot of diabetic patients once a year. This indicate that they are oriented with recent clinical guidelines for the management of DM. Availability of the clinical guidelines at workplace was significantly associated with better knowledge and practice among primary care physicians in Al Hasa.⁸ However, in Estonia, the physicians' knowledge and behavior in the management of type 2 diabetes was not associated with the availability of clinical guidelines.³⁰ Also other studies have proven that mere availability of guidelines did not improve the knowledge and practice of the physicians in the management of diabetes. The most important is their adherence to these guidelines.^{31,32} Chwalow et al.²⁴ reported that about 90% of family physicians followed the clinical guide lines for diabetic management. In accordance with Niroomand et al¹⁸, the least properly practiced issue was the timing for diabetic foot examination.

In the present study, unexpectedly, physicians with history of DM among first degree relatives expressed lower practice than those without such history. Further research is needed to clarify this unexpected finding.

The current study, up to our knowledge, is the first one which assessed the KAP of GPs in Jeddah, who have an essential role in diabetes management. In addition, we applied a valid tool and used a suitable sample of GPs. Despite these strengths, the study has some important limitations including the cross-sectional design as the causal relationships cannot exactly be investigated

in this type of studies. We did not have any information about whether the physicians had participated in workshops and diabetes training courses or not. The study included GPs from MOH sector only which could influence the generalizability of results. Finally, self-reporting of practice is subjected to bias as physicians may overestimate their practice.

In conclusion, knowledge of general practitioners working at primary healthcare centers, Ministry of health in Jeddah was overall acceptable. However, deficient knowledge was observed among some important aspects of diabetes mellitus. More than half of physicians had positive attitude towards control of diabetes, with no influence of demographic factors. Practice of the physicians was suboptimal in some important issues. Physicians working at diabetic clinics and those without family history of DM among first degree relatives expressed better practice. Organizing continuous medical educational activities for primary healthcare physicians in Jeddah regarding diabetes and its management and encouragement of the general practitioners to follow clinical guidelines for DM management are recommended.

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