

# Prevalence of diabetes mellitus in tertiary care outpatient clinic at family medicine department king Faisal specialist hospital, Jeddah

## Abstract

**Background:** The International Diabetes Federation estimates that Saudi Arabia has the 7th highest prevalence of diabetes worldwide (18.5%). There exists, however, a lack of local data regarding prevalence of diabetes in the western Saudi population. King Faisal Specialist Hospital & Research Centre Jeddah is a tertiary care facility with an influx of complex tertiary care patients with preexisting comorbidities. It was hypothesized that the prevalence of diabetes among the patients referred to the Family Medicine Department would be even higher than the prevalence in the general population in Saudi Arabia.

**Objectives:** To determine the prevalence of diabetes in tertiary care patients with preexisting comorbidities and to describe characteristics associated with the disease in this study population.

**Design:** Retrospective electronic chart review

**Setting:** Outpatient Family medicine clinic at King Faisal Specialist Hospital & Research Centre.

**Methods:** Electronic charts were reviewed for all patients attending the investigator's once weekly family medicine clinic from 1st October 2017 to 31st March 2018.

**Main Outcome Measures:** The primary outcome was the prevalence of diabetes among the patients attending the family medicine clinic in the six month time period. Mean differences in age and BMI were compared by gender and diabetes status and the association between gender and diabetes status was assessed.

**Results:** The study population included 204 tertiary care patients, 129 of whom had a diagnosis of diabetes (128 with Type 2 Diabetes and 1 patient with Type 1 Diabetes), indicating an overall prevalence 63.2%. Twelve subjects (5.9%) met the definition for being prediabetic and 14 subjects (6.9%) had no screening for diabetes. The association between diabetes status and gender was statistically significant with 69 out of 204 (33.8%) patients being diabetic women and 60 out of 204 (29.4%) being diabetic males compared to non-diabetic patients and patients with unknown status ( $p$ -value=0.003). Among males, 75% had diagnosed diabetes compared to 55.7% of females with diagnosed diabetes in this cohort. Mean age in subjects with diabetes was  $60.4 \pm 10.9$  years (range: 32-89) and mean BMI was  $32.8 \pm 6.2$  kg/m<sup>2</sup> (range: 18.7-51.9). The mean age was significantly different for patients with diagnosed diabetes ( $\mu=60.4$ ) compared to those without diabetes ( $\mu=53.6$ ) and those with unknown status ( $\mu=46.0$ ) ( $p$ -value<0.0001).

**Conclusion:** The prevalence of diabetes is significantly higher in this patient population compared to the estimated prevalence in the general Saudi population. Enhanced policies for diabetes services provision and prevention programs are needed in addition to the development of educational materials and appropriate allocation of resources.

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## How this fits in

This study provides the first ever evidence on excessive prevalence of diabetes in this specific cohort of patients which is far higher than the national estimated prevalence of diabetes in general adult population in Saudi Arabia, proving the excessive and true burden of this condition in these patients. Evidence from this study is highly important for healthcare providers as it forms the basis of the case for developing enhanced care models, need for diabetes program planning, development of educational materials, and appropriate allocation of resources for prevention and management of this condition.

## Introduction

The rapidly increasing global prevalence of diabetes is a significant cause for concern. This epidemic has resulted in dreadful health, social, and economic consequences. Patients with type 2 diabetes have a two to four-fold increased risk of developing cardiovascular disease compared to individuals without diabetes.<sup>1</sup> Cardiovascular disease is a major cause of death and disability in people with diabetes, accounting for 44% of fatalities in people with type 1 diabetes and 52% of fatalities in people with type 2 diabetes.<sup>2</sup> Type 2 diabetics have a two-fold increased risk of stroke within the first five years of diagnosis compared with the general population.<sup>3,4</sup>

In relation to hospital admissions, there is a 75.7% increased risk of angina, a 55.1% increased risk of myocardial infarction, a 73.2% increased risk of heart failure, and a 34.1% increased risk of stroke among people with both types of diabetes.<sup>5</sup> This translates to roughly one quarter of hospital admissions for heart failure, heart attack, and stroke being in people with diabetes. The same data suggests that the likelihood of death within a year in this population is increased two to five times, with heart failure being the most common and the most deadly cardiovascular complication of diabetes.<sup>5</sup>

Diabetes currently affects 425 million people worldwide and is expected to affect 629 million by 2045.<sup>6</sup> According to the 2017 International Diabetes Federation (IDF) report, 4.0 million deaths were attributable to diabetes. An even greater number die from cardiovascular disease exacerbated by diabetes-related lipid disorders and hypertension. Thirty five of the 219 countries (16%) covered in the report have diabetes prevalence of 12% or above. These countries are located mainly in the Western Pacific, the Middle East and North Africa. While developed countries such as those in the United Kingdom have robust epidemiological data resources such as the Quality Outcome Framework Data (QOF), currently there is no such tool available in Saudi Arabia for providing prevalence estimates in the local populations.<sup>6</sup>

Diabetes is one of the biggest health challenges currently facing Saudi Arabia. The prevalence of diabetes is four to six-fold higher in people from Asian background in comparison to Caucasians. The onset of type 2 diabetes in individuals of Asian descent can be expected to occur up to a decade earlier and Asians present with much higher rates of cardiovascular complications, morbidity in general, and mortality.<sup>7</sup> While figures from the IDF reflect an estimated prevalence of diabetes of 18.5% in Saudi Arabia,<sup>6</sup> there is a lack of local level data to provide more accurate prevalence estimates for diabetes among local populations. The King Faisal Specialist Hospital & Research Centre (KFSH&RC) Family Medicine Department provides primary care services to all tertiary care patients referred from other specialty departments. It was hypothesized that the prevalence of diabetes among these tertiary care patients attending a once weekly Family Medicine clinic would be higher than the prevalence in the general population in Saudi Arabia. The aim of this study is to identify the true burden of disease in a tertiary care patient population.

## Methods

Data for this study came from the retrospective electronic chart review of tertiary care patients attending scheduled appointments in the Family Medicine Department after being referred from another hospital specialty department to this weekly clinic. Charts for all patients seen in the clinic over a six month period, from 1st October 2017 to 31st March 2018, were reviewed. Patients were referred from over 20 departments, with the greatest number coming from Cardiology (n=53) followed by Neurology (n=26) and Oncology (n=20). Demographic and clinical characteristics were collected using Cerner and included: age, gender, BMI, diabetes status, diabetes type, insulin and other hypoglycemic drug use, and last HbA1c value.

The primary outcome of interest in this study was the prevalence of diabetes in this tertiary care patient population. Diabetes diagnosis was based on the American Diabetes Association criteria for diagnoses of diabetes.<sup>8</sup> Descriptive statistics were obtained for the overall study population including mean ( $\mu$ )  $\pm$  standard deviation (SD) for age, BMI, and last HbA1c values and frequencies for gender, insulin use,

and other diabetic drug use. The data was also analyzed by gender and diabetic groupings. The association of gender and diabetes status was observed using the Chi-square test. The Student's t-test was used to determine if the mean BMI and mean age values differed by gender. Analysis of variance was used to compare mean values of BMI and age across diabetes status. Patients with unknown diabetes status were compared to those with a diagnosis by gender, age, and BMI. Analyses were performed using SPSS 22.0 and SAS version 9.4 and statistical significance was determined at an  $\alpha=0.05$  level. This study was approved by the Institutional Review Board at the KFSH&RC, Jeddah.]

## Results

Overall, 204 patients attended the Family Medicine clinic during the six month study period. This total included 124 (60.8%) females and 80 (39.2%) male patients (Table 1). Over half of the patients (n=128) had a confirmed prior diagnosis of type 2 diabetes and 1 patient had a confirmed prior diagnosis of type 1 diabetes. While the overall prevalence of diabetes in the study population was 63.2% (n=129), 61 (29.9%) patients were confirmed not to have diabetes and 14 (6.9%) had an unknown status for diabetes diagnosis (Table 1). Of the 129 patients with diagnosed diabetes, 69 (53.5%) were female and 60 (46.5%) were male. Twelve of the patients had a confirmed diagnosis of prediabetes. There were no significant differences with regards to gender distribution or mean BMI for patients with a diagnosis for diabetes compared to those patients with no diagnosis available. The patients with unknown diabetes status were significantly younger than those with a diagnosis ( $p=0.0006$ ).

**Table 1** Descriptive statistics for patient population (n=204)

Variable	n(%)	mean $\pm$ SD
Age		57.4 $\pm$ 13.1
Gender		
Male	80 (39.2)	
Female	124 (60.8)	
BMI		32.5 $\pm$ 6.5
Diagnosis		
Diabetic <sup>1</sup>	129 (63.2)	
Non-diabetic	61 (29.9)	
unknown	14 (6.9)	
Last HbA1c value <sup>2</sup>		8.2 $\pm$ 1.8
Insulin use <sup>3</sup>		
Yes	53 (41.1)	
No	60 (46.5)	
Hypoglycemic drug use <sup>3</sup>		
Yes	27 (20.9)	
No	99 (76.7)	

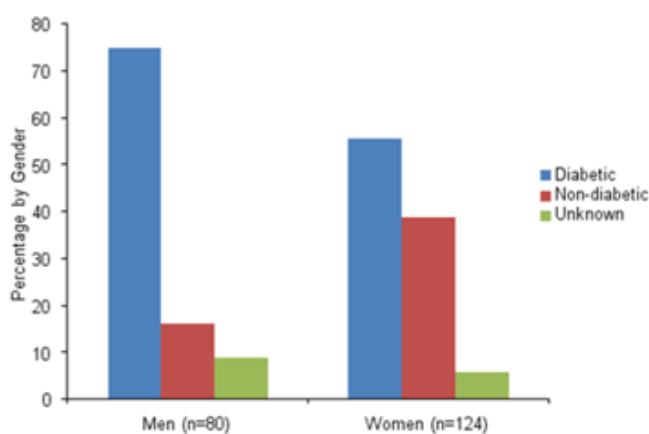
<sup>1</sup>Total includes 1 patient with Type 1 diabetes and 128 patients with Type 2 diabetes

<sup>2</sup>for patients with diagnosed diabetes (n=129)

<sup>3</sup>percentages may total <100 due to missing drug information for diabetic patients

The association between diabetes status and gender was statistically significant with 69 out of 204 (33.8%) patients being diabetic women and 60 out of 204 (29.4%) patients being diabetic men compared to 48/204 (23.5%) non-diabetic and 13/204 (6.4%) non-diabetic men and 7/204 women (3.4%) and 7/204 men (3.4%) with unknown diabetes status ( $p=0.003$ ) (Table 2). Overall, the prevalence of diagnosed diabetes in male patients was 75.0% compared to males

who were non-diabetic (16.3%) or had an unknown status (8.8%) while the prevalence of diagnosed diabetes in female patients was 55.7% compared to women who were non-diabetic (38.7%) or had an unknown status (5.7%) (Figure 1). The mean age of all subjects was  $57.4 \pm 13.1$  years (range: 18-89) with no significant difference in the mean ages of female patients ( $\mu=58.4$ ) and male patients ( $\mu=55.8$ ) ( $p=0.16$ ). Analysis of variance revealed that the mean ages for diabetic patients ( $\mu=60.4$ ), for non-diabetic patients ( $\mu=53.4$ ), and for patients with unknown diabetic status ( $\mu=46.0$ ) were significantly different ( $p<0.0001$ ) (Table 2) (Figure 2A).



**Figure 1** Prevalence of disease diagnosis by gender (n=204).

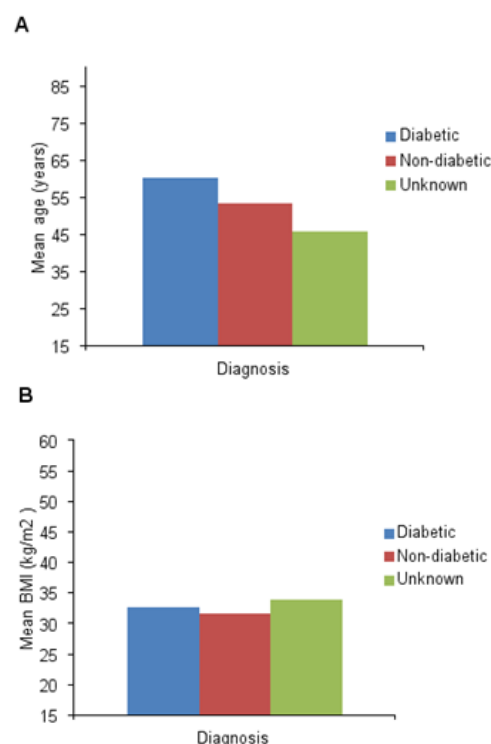
**Table 2** Patient characteristics by diabetic status (n=204)

Variable	diabetic patients <sup>1</sup> (n=129)	non-diabetic patients (n=61)	unknown diabetic status (n=14)	p-value
Age	60.4±10.9	53.6±14.0	46.0±17.2	<0.0001
Gender				
Male	60 (29.4)	13 (6.4)	7 (3.4)	0.003
Female	69 (33.8)	48 (23.5)	7 (3.4)	
BMI	32.8±6.2	31.7±5.9	33.9±10.8	0.43

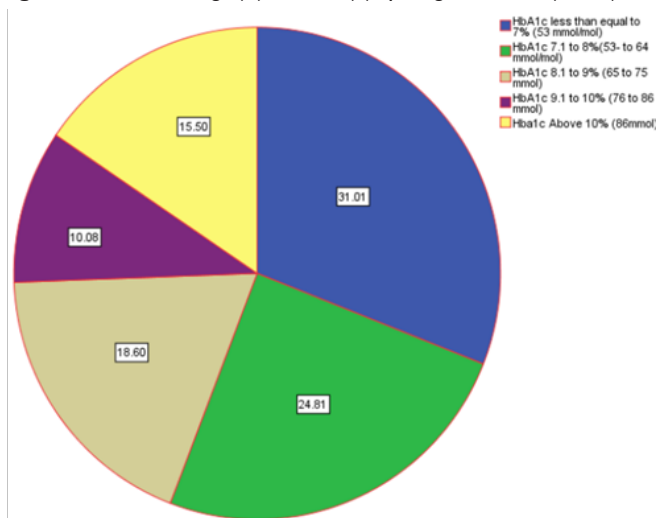
<sup>1</sup>Total includes 1 patient with Type 1 diabetes and 128 patients with type 2 diabetes

The mean BMI of all subjects in the study was  $32.5 \pm 6.5$  kg/m<sup>2</sup> (range: 18.3-55) (Table 1). The mean BMI for women ( $\mu=33.1$ ) and the mean BMI for men ( $\mu=31.6$ ) were not statistically different ( $p=0.11$ ). Analysis of variance showed no statistically significant difference ( $p=0.43$ ) in the mean values for BMI of diabetics ( $\mu=32.8$ ), non-diabetics ( $\mu=31.7$ ) and patients with unknown diabetic status ( $\mu=33.9$ ) (Table 2) (Figure 2B).

The mean and standard deviation for the last HbA1c value in diabetic study participants was  $8.2 \pm 1.8\%$  (range: 5.5-13.7). Diabetic females had a mean age of  $61.0 \pm 10.5$  years, a mean BMI of  $34.3 \pm 6.8$  kg/m<sup>2</sup>, and a mean HbA1c of  $7.8 \pm 1.6\%$  while male patients had a mean age of  $59.8 \pm 11.4$  years, a mean BMI of  $31.1 \pm 5.1$  kg/m<sup>2</sup>, and a mean HbA1c of  $8.6 \pm 2.0\%$ . Among diabetics, 31.0% had a HbA1c value less than 7.00% (53 mmol/mol), 24.8% had HbA1c values between 7.01 to 8.00% (54-64 mmol), 18.6% of patients had a value between 8.01-9.00 % (65-75 mmol/mol), 10.1% had values between 9.01%-10.00% (75-86 mmol), and 15.5% of all people with diabetes had HbA1c values greater than 10.01% (86 mmol/mol) (Figure 3). Further analysis of the patients with diabetes revealed that the mean HbA1c for the insulin treated patients was 9.41% with the mean age of patients using insulin being 63.3 years.



**Figure 2A & B** Mean Age (A) and BMI (B) by Diagnosis status (n=204).



**Figure 3** Glycemic control based on last HbA1c test for diabetic patients (n=129).

Regarding pharmacological interventions, 89 of the 129 (69%) patients were taking Metformin, either alone (28.7%) or in a fixed drug combination with a DPP4 inhibitor, Sitagliptin (40.3%). It is important to note that Sitagliptin is the only available formulary approved DPP4 inhibitor in this hospital. The mean number of oral hypoglycemic agents known to be used by the diabetic patients with drug information available (n=126) was  $1.5 \pm 0.9$ . Sulphonylurea use was low with only 21% of all patients with type 2 diabetes on Gliclazide.

Under half, 53 (41.1%) of the 129 patients with diabetes were known to be using insulin. The basal bolus combination was the most popular (72.7%). Among all patients on insulin, 21.8% were using

basal only insulin. Premixed insulin was used in 5.5% of all patients on insulin.

## Discussion

This study provides evidence to support the hypothesis that the prevalence of diabetes among tertiary care patients at KFSH&RC is higher than the prevalence of diabetes among members of the general population in Saudi Arabia. Further analysis revealed that disease management could be improved as is evidenced by the high percentage of diabetic patients in this study with poor glycemic control. There is an urgent need for further development of enhanced diabetes services for these patients who are at an increased risk of cardiovascular and diabetes related complications.

Current study findings present a strong case to develop integrated diabetes service provisions for tertiary care patients of all ages. The patients with unknown diabetes status in this study were significantly younger than those with a diagnosis for the disease. Providing routine screening for diabetes at an earlier age could help to identify those at risk for complications due to having undiagnosed disease. Being able to manage the disease medically closer to the time of onset could reduce the risk of future complications. For patients who are prediabetic, proper education regarding preventative measures could help to prevent development of the disease in the future.

Integrated Diabetes service provision models are shown to improve diabetes care to achieve better outcomes for people with diabetes.<sup>9,10</sup> Epidemiological data can be used to monitor health of patients, to guide clinical practices, and to affect policy decisions for services development. It can also facilitate diabetes program planning, development of educational materials, and appropriate allocation of resources for prevention and management of this condition.

## Comparison with existing literature

Although there are publications regarding the National prevalence of diabetes in Saudi Arabia,<sup>11,12</sup> there is lack of evidence and information on prevalence of diabetes among specific sub group of patients such as included in this study focusing on diabetes prevalence in patients currently attending Family Medicine clinics at King Faisal Specialist Hospital & Research Centre Jeddah which is a tertiary care facility with an influx of complex tertiary care patients with preexisting co morbidities.

In 2004, a community-based national epidemiological health survey was conducted among Saudi subjects.<sup>11</sup> Study included the age group of 30–70-years of selected households. It was conducted over a 5-year period. Data obtained from history, fasting plasma glucose levels, and body mass index was analyzed to classify individuals as diabetic, impaired fasting glucose and with no diabetes. A total of 17232 Saudi subjects were selected in the study, and 16917 participated (98.2% response rate). Four thousand and four subjects (23.7%), out of 16917 were diagnosed to have Diabetes. Thus, the overall prevalence of DM obtained from this study was 23.7% in KSA. However, it can be argued that these prevalence figures for diabetes mellitus were obtained 14 years ago in a community setting using a survey and results may not accurately capture the current true prevalence of diabetes in Saudi Arabia and in particular diabetes prevalence among specific subgroup of patients such as included in this study focusing on prevalence of diabetes among specific subgroup of patients currently attending Family Medicine clinics at King Faisal Specialist Hospital & Research Centre, Jeddah.

## Implications for research and practice

Whilst the study provides evidence on this excess burden of diabetes in this cohort of patients; it poses serious questions for the clinical practice, since the prevalence of diabetes is so high in these patients who attend family medicine for their routine primary care needs, study results justify the clinical need to develop a new diabetes delivery model with a focus on dedicated diabetes clinics.

Results from this study also demands that further research is undertaken to establish evidence on the causes of this excess prevalence of diabetes in this cohort of patients. Further studies are also needed to establish prevalence of other long term conditions, co-morbidities and complications from diabetes that may co exist in these patients attending family medicine clinics.

## Limitations of the study

One limitation to this study is the generalizability of the study results to the overall population in Saudi Arabia. Despite patient referral patterns that extend over a wide geographic area, the study population was limited to tertiary care Family Medicine patients with other comorbidities attending the investigator's once weekly clinic. There were 14 patients in the study with no previous diabetes screening results available in the electronic records, accounting for 6.9% of the study population. Including these individuals in the analyses may have resulted in an underestimation of the prevalence of diabetes in this group of patients. Overall, a prevalence of 63.2% for diagnosed diabetes indicates a need for a greater emphasis on screening, prevention, and management of this condition in tertiary care patient population.

## Acknowledgment

None.

## Conflict of interest

None.

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