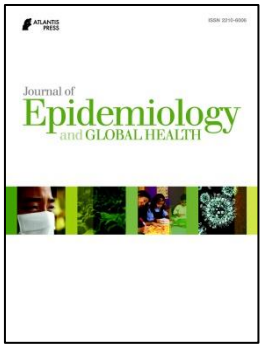

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Cardiovascular risk profiles of adults with type-2 diabetes treated at urban hospitals in Riyadh, Saudi Arabia

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Abstract Diabetes mellitus substantially increases cardiovascular disease (CVD) risk. Among Saudi Arabian citizens with diabetes, little is known about the prevalence and control of other CVD risk factors.

We extracted data from medical records of a random selection of 422 patients seen between 2008 and 2012 at two diabetic clinics in Riyadh, Saudi Arabia. We calculated the proportion of patients who had additional CVD risk factors: obesity (body mass index $\geqslant$ 30 kg/m^2), hypertension (BP $\geqslant$ 140/90 mmHg), elevated cholesterol fractions, and multiple risk factors). Further, we calculated the proportion of patients meeting the American Diabetes Association's recommended care targets for each risk factor.

Of 422 patients (mean age, 52 years), half were women, 56% were obese, 45% had hypertension, and 77% had elevated LDL concentrations. In addition to diabetes, 70% had two or more CVD risk factors. Although 9% met both target HbA1c and BP values, only 3.5% had optimum HbA1c, BP, and lipid values.

In Saudi Arabia's best diabetes clinics, most patients have poor control of their disease. This huge disease burden and related care gaps have important health and financial implications for the country.

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1. Introduction

Since 2000, several studies have estimated the prevalence of type-2 diabetes mellitus (DM) in the Kingdom of Saudi Arabia (KSA) to be between 20% and 35% [10—12], the third highest in the world [10]. Diabetes is the most costly medical disorder in the KSA, consuming 23% of the healthcare expenditures and 11% of all direct medical services [13]. One out of every five Saudi patients with diabetes experiences nephropathy, which can lead to end-stage renal disease. The per-patient cost for dialysis in the KSA is $14,000 per year, with a total cost of $540 million for the country for all diabetes-related dialysis [14]. Additionally, the approximate cost of managing one patient with an amputation ranges between $40,000 and $75,000 per year [15], and 4000 foot or leg amputations are performed in KSA each year [1].

Patients with diabetes also have a higher risk of cardiovascular disease (CVD) compared with patients without diabetes [2]. Adjusting for age, obesity, hypertension, dyslipidemia and tobacco use, people with diabetes still have a fourfold greater risk of experiencing a CVD event than do people without diabetes [3,4]. Additionally, the risk of a first myocardial infarction (MI) in patients with diabetes is five times as high as that for non-diabetics, and the risk for recurrent MI is twice that of people with a history of MI who do not have diabetes [5]. Patients with diabetes also have an increased risk of stroke [6].

In 2009, in the KSA, 2.7% of patients with diabetes also had CVD [11]. Awareness of the risks of developing CVD is low among those with diabetes. Risk factors for CVD (obesity, hypertension, dyslipidemia) are commonly observed in diabetes clinics, but the actual proportion of diabetic patients with these risk factors and how well they are being controlled is unknown.

Several studies of patients with diabetes have found that close control of glycemia and major CVD risk factors, such as hypertension and dyslipidemia, substantially reduced CVD morbidity and mortality [7,16—18]. The United Kingdom Prospective Diabetes Study (UKPDS) reported that a 1% reduction in HbA1c concentration decreased micro- (e.g., retinopathy, nephropathy, neuropathy) and long-term macro-vascular (e.g., coronary events and strokes) diabetes-related complications and mortality [19].

Given the high human and financial costs of diabetes and CVD, it is important to determine the scope of the problem in the KSA. It was reasoned that the patients most likely to have these risk factors under control were those being treated at diabetes clinics at leading major urban hospitals. Accordingly, the present study was undertaken to determine the proportion of diabetes patients at two of these clinics who had other CVD risk factors and how well their risk factors were controlled.

2. Methods

The study was approved by the Institutional Review Boards of Emory University (Atlanta, USA) and King Fahd Medical City (KFMC) (Riyadh, KSA). This study involved collaboration with the KSA's Ministry of Health (MoH).

2.1. Research questions

Three research questions were asked:

1) What are the proportions of patients with type-2 diabetes seen at two leading diabetes clinics in Riyadh, KSA, between 2008 and 2012, who presented with other CVD risk factors?
2) What proportion of these patients was meeting the American Diabetes Association's recommended care targets for these CVD risk factors?
3) What protocols were associated with achieving optimal control of CVD risk factors in these patients?

The literature shows some variation in CVD risk factors among men and women in the KSA; therefore, data were analyzed for men and women separately.

2.2. Study population

Data were collected from medical records chosen by a systematic random sampling of outpatients treated at the diabetes clinics of KFMC's Diabetic Center and Prince Salman Hospital's Al Sheikh Diabetic Center. Patients were eligible if they had a diagnosis of type-2 diabetes, were between 30 and 79 years old, were Saudi nationals, had no previous history of CVD, and were not pregnant.

2.3. Sampling procedure

Records were systematically selected at each hospital. At Prince Salman Hospital, patient data were stored in a paper-based filing system. As such, every third file on every shelf was selected. If the patient was eligible for the study, the information was abstracted from the record. If not, the record was ignored and the next third file was taken.

At KFMC, patient data were stored electronically. A systematic random list of all patients with