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# Uncontrolled diabetes mellitus: Prevalence and risk factors among people with type 2 diabetes mellitus in an Urban District of Karachi, Pakistan

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## ABSTRACT

**Aims:** This study aimed to explore the prevalence of, and factors associated with, uncontrolled diabetes mellitus (UDM) in a community setting in Pakistan.

**Methodology:** A single-center, cross-sectional study, conducted in a community-based specialized care center (SCC) for diabetes in District Central Karachi, in 2003, registered 452 type 2 DM participants, tested for HbA1c and interviewed face-to-face for other information. Logistic regression analysis was conducted to identify factors associated with UDM.

**Results:** Prevalence of UDM among diabetes patients was found to be 38.9% (95% CI: 34.4–43.4%). Multivariable logistic regression model analysis indicated that age <50 years (OR: 1.9; 95% CI: 1.2–2.9), being diagnosed in a hospital (vs. a clinic) (OR: 1.8; 95% CI: 1.1–2.8), diabetes information from a doctor or nurse only (vs. multiple sources) (OR: 1.8; 95% CI: 1.2–2.9), higher monthly treatment cost (OR: 1.3; 95% CI: 1.1–1.6; for every extra 500 PKR), and higher consumption of tea (OR: 1.5; 95% CI: 1.0–2.2; for every 2 extra cups) were independently associated with UDM.

**Conclusion:** The prevalence of UDM was approximately 39% among persons with type 2 diabetes visiting a community based SCC for diabetes. Modifiable risk factors such as sources of diabetes information and black tea consumption can be considered as potential targets of interventions in Karachi.

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## 1. Introduction

In 2011 that estimate has escalated to 366 million, and the projection for 2030 is 552 million (about 50% increase) [1]. The largest increase (92%) has been projected for countries in the lowest income group. An estimated 2.9 million deaths were attributed to Diabetes globally in the year 2000 [2].

Pakistan, a developing South Asian country, has an estimated 6.3 million persons with diabetes (PWD) with an age adjusted prevalence of 7.9% among adults a 20 years or older. In the absence of major interventions, Pakistan in 2030 will have an estimated 11.4 million PWD and prevalence of 8.9% [1].

Chronic hyperglycemia, a major pathological feature of DM, represented by high HbA1c levels, is associated with high mortality and morbidity due to cardiac and renal complications [3–6]. Hence, one of the major goals of treatment of DM is to keep blood glucose levels as close to normal as possible yet avoiding hypoglycemia by maintaining HbA1c below a certain level, thus minimizing the risk of complications of DM. The American Diabetes Association, International Diabetes Federation, Canadian Diabetes Association and Diabetes Australia all recognize a HbA1c level of 7% (53 mmol/mol) or less as optimal control [7–10]. Korean and Malaysian guidelines consider 6.5% (48 mmol/mol) or less as the optimal [11,12]. A Chinese study recommended using different HbA1c cut-offs, ranging from <6.0% (42 mmol/mol) to <9.0% (<42 to <74 mmol/mol), for various risk groups [13]. Consequently, depending upon the criteria being used, anyone with HbA1c levels above a pre-determined cut-off point can be considered as having Uncontrolled Diabetes Mellitus (UDM).

Studies on DM conducted in Pakistan during the last decade have reported on the prevalence of ‘uncontrolled’ type 2 DM [6,14–18]. All identified studies, except Shera et al., included patients attending tertiary care hospitals, and all, but one used retrieved data from patient’s records and data quality is questionable. Many of these studies chose cut-offs for HbA1c levels that were not congruent with cut-offs put forth by major international guidelines for categorizing patients as regards their DM control (Table 1) [7–10]. Rationales for selecting a particular cut-off were either inadequately cited or not provided in respective reports. Shera et al. recruited patients from a WHO collaborating center within a defined city district. Thus all of the above studies were conducted on selected subgroups vs. the general population.

Therefore, the need still exists to know the magnitude of UDM in settings more closely representing community based specialized care center (SCC) for diabetes. In addition, none of the published studies evaluated factors related to UDM, which may guide physicians to better manage their patients and achieve better DM control. Thus, the objectives of our study were: (a) to estimate the prevalence of UDM (HbA1c  $\geq$  8% [64 mmol/mol]) among type 2 DM patients attending a community-based SCC for diabetes in Karachi, Pakistan and (b) to determine factors associated with UDM (HbA1c  $\geq$  8.0% [64 mmol/mol]).

## 2. Methods

### 2.1. Study settings

Karachi is the southernmost metropolis of Pakistan with a population of over 10 Million [19]. In this study, subjects were recruited from a well-established outpatient SCC for diabetes in the central city providing subsidized care to low income patients, with extended operational hours; average daily attendance was 60 patients. The center explicitly used American Diabetes Association diagnostic and management guidelines, had standardized laboratory procedures, and maintained the records of all registered patients allowing for an organized system for patient follow-up.

### 2.2. Study design and subjects

This was a cross-sectional study, which recruited people having type 2 DM of age  $\geq$ 25 years; diagnosed at least 3 month prior to the date of registration in the study; and presenting to the study center during the study recruitment period. Any patient having at least one of the following was excluded from the study: serious complications of diabetes; concurrent illness that would limit lifestyle changes; pregnant or lactating women; or incompetent to respond to study requirements. All type 2 DM patients, as diagnosed by the treating physicians at the clinic, attending the study center during September 2002 to January 2003, who satisfied the inclusion and exclusion criteria, and gave consent to take part in the study were consecutively recruited in the study.

**Table 1 – HbA1c cut-off values used by authors reporting prevalence of uncontrolled DM among persons with type 2 diabetes from Pakistan (2004–2010).**

Categories of DM control	Shera et al. 2004 [6]	Mahmood et al. (2005) [14]	Basit et al. (2005) [15]	Ahmed et al. <sup>a</sup> (2008) [16]	Khan et al. (2009) [17]	Khowaja et al. (2010) [18]
Good	<7	$\leq$ 7	$\leq$ 7	$\leq$ 7.5	$\leq$ 6.5	4.5– $\leq$ 6.1
Fair/acceptable	7– $\leq$ 8	7.1– $\leq$ 8.2	Not considered	Not considered	>6.5–8.4	6.2– $\leq$ 7.4
Poor	>8	>8.2	>7	>7.5	>8.4	>7.4
Poor control (%)	28.4	51.4	81.3	42.0	59.0	51.6

<sup>a</sup> Authors categorized as: normal = <6.7; good = 6.7– $\leq$ 7.5; poor = >7.5. We considered categories ‘normal’ and ‘good’ as the same. HbA1c% = NGSP units (IFCC units): 6.5 = 48; 7 = <53; 7.5 = 59; 8 = 64; 8.5 = 70.

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