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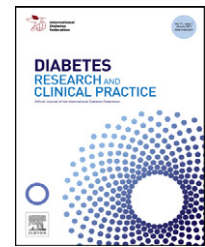
Prevalence of undiagnosed diabetes mellitus and cardiovascular risk factors in Hong Kong professional drivers

S.C. Siu [a,*], K.W. Wong [a], K.F. Lee [b], Y.Y.C. Lo [c], C.K.H. Wong [c], A.K.L. Chan [d], D.Y.T. Fong [e], C.L.K. Lam [c]

[a] Diabetes Centre, Department of Medicine and Rehabilitation, Tung Wah Eastern Hospital, Hong Kong SAR, China
[b] Diabetes Centre, Department of Medicine and Geriatrics, Kwong Wah Hospital, Hong Kong SAR, China
[c] Department of Family Medicine and Primary Care, The University of Hong Kong, Hong Kong SAR, China
[d] General Practice, Hong Kong SAR, China
[e] Department of Nursing Studies, The University of Hong Kong, Hong Kong SAR, China

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ABSTRACT

Aims: To investigate the prevalence of undiagnosed diabetes mellitus (DM) and cardiovascular risk factors among professional drivers in Hong Kong.

Methods: Chinese professional drivers with no history of DM were invited to complete a questionnaire on their health status, followed by taking their body measurements, fasting blood glucose (FG) and lipids. 75 g OGTT were performed when FG $\geq$ 5.6 to <7.0 mmol/L.

Results: Of these 3376 drivers (male 92.6%, mean age 50.9 ± 7.6 years), the prevalence of undiagnosed DM, prediabetes, and metabolic syndrome was 8.1% (272/3376, 95% CI 7.1–9.0%), 10.0% (337/3376, 95% CI 9.0–11.0%) and 26.8% (904/3376, 95% CI 25.3–28.3%) respectively, while the corresponding WHO Standard Population age-standardized prevalence was 7.8%, 9.0% and 24.7% respectively. Many of them were obese (51.2%), had hypertension (57.0%) and high cholesterol (58.7%), and a third had hypertriglyceridaemia (34.9%) and low HDL-cholesterol (29.3%). Their median working hours were 60.0 (IQR 14) h. Majority had exercise <1 h/week (56.0%) and ate out $\geq$6 times/week (54.9%).

Conclusions: Hong Kong professional drivers have higher prevalence of undiagnosed DM, cardiovascular risk factors and metabolic syndrome than the general population. Therefore, health care measures targeting against them should be taken to prevent and detect DM and cardiovascular diseases.

1. Introduction

Diabetes mellitus (DM) is common in Hong Kong [1]. With the spread of western lifestyle, the prevalence of diabetes mellitus is predicted to increase in the coming decades [2]. The care of this large group of people with diabetes mellitus is imposing a heavy burden to the local community. Fortunately, lifestyle modification has been shown to be effective in preventing diabetes mellitus [3], reducing the cardiovascular diseases risk factors [4] and be associated with a lower mortality among men [5]. Lifestyle modification is also cost effective [6].

Professional drivers have been reported by overseas studies to have adverse working condition and unfavourable lifestyle [7,8], which are associated with higher risk of hypertension, myocardial infarction and glucose intolerance [9,7,10], higher hospital admissions [11] and higher mortality [12]. Furthermore, most professional drivers are not aware of the association of diabetes mellitus with their obesity [13]. Of concern to public safety, professional drivers and particularly those with diabetes mellitus or cardiovascular diseases have been found to encounter more traffic accidents [14].

In Hong Kong, there is a large population of 400,000 professional drivers [15]. Yet, there is little data on their health status to guide the planning of preventive and medical health care for them. In this study, we aimed to find out the prevalence of undiagnosed diabetes mellitus and cardiovascular risk factors among professional drivers in Hong Kong to inform the public, health professionals and service planners.

2. Subjects and methods

2.1. Subjects

The study was part of the Hong Kong professional driver community project to raise their awareness of diabetes mellitus. Chinese professional drivers of both sexes, aged 18–70 years, were invited through the media and drivers' groups to join the study by attending two local diabetic clinics. They were excluded if they had history of known DM either on diet or any drug treatment. Drivers who had driving duration less than 6 months, working hours less than 10 h per week or had retired from driving for 3 months or more were excluded from study. Informed consent was obtained from all drivers and the study was approved by the Ethics Committee of the Hong Kong East Cluster Hospitals of the Hospital Authority.

2.2. Measurements

All drivers were requested to complete a questionnaire on their lifestyle habits and medical history with the help of a research assistant. The mean of two anthropometric measurements was recorded. Body weight and height were taken while on light clothing with no shoes. Waist circumference (WC) was measured in a horizontal plan around the abdomen at the top of the right iliac crest at the end of normal expiration [16]. Blood pressure (BP) was measured after sitting for 15 min by BP monitor (Colin BP 8800-C). Blood samples were taken for glucose and lipid profile after fasting for 12 h. Plasma glucose, triglycerides (TG), total cholesterol (TC) and high density lipoprotein cholesterol (HDL-C) were measured using the Abbott Architect c16000 chemistry analyzer. Low density lipoprotein cholesterol (LDL-C) was derived from the Friedewald formula [17].

2.3. Definition of DM, prediabetes and metabolic syndrome

Drivers with fasting glucose (FG) $\geq$ 7.0 mmol/L were classified to have diabetes mellitus [18]; those with fasting glucose $\geq$ 5.6 mmol/L and <7.0 mmol/L were further assessed by

75 g oral glucose tolerance test (OGTT) to establish the diagnosis of DM or impaired glucose tolerance (IGT). DM was defined by FG $\geq$ 7.0 mmol/L or 2 h plasma glucose $\geq$ 11.1 mmol/L whereas IGT was defined by FG <7.0 mmol/L and 2 h plasma glucose $\geq$ 7.8–11.0 mmol/L [19]. Impaired fasting glucose (IFG) was defined as FG $\geq$ 5.6 to <7.0 mmol/L [20]. Drivers were classified to have prediabetes if they had either IFG or IGT [21]. Asian modified cut-off values of body mass index (BMI) $\geq$ 25 kg/m^2 and WC ($\geq$90 cm for male and $\geq$80 cm for female) were used to define obesity and central obesity [22]. Hypertension (HT) (systolic BP $\geq$ 130 mmHg or diastolic BP $\geq$ 85 mmHg, or history of HT on treatment), hypertriglyceridaemia (TG $\geq$ 1.7 mmol/L) and reduced HDL-cholesterol (male < 1.03 mmol/L, female < 1.29 mmol/L) were defined using the International Diabetes Federation (IDF) definition [23]. Drivers were considered to have metabolic syndrome (IDF definition) when they had central obesity plus two of the following four criteria, namely HT, FG $\geq$ 5.6 mmol/L, hypertriglyceridaemia and reduced HDL-cholesterol [23].

2.4. Outcome measures and statistical analysis

The primary outcome was prevalence of undiagnosed diabetes mellitus. The rates of prediabetes, cardiovascular risk factors and metabolic syndrome were secondary outcomes.

Socio-demographics, medical history and lifestyle characteristics of professional drivers were summarized by descriptive statistics. The age-standardized prevalence rates of undiagnosed DM, pre-diabetes, metabolic syndrome and cardiovascular risk factors were calculated with reference to the World Health Organization (WHO) World Standard Average Population 2000–2025 [24]. Their differences between genders were assessed by Chi-square test or Independent t-test. Univariate logistic regression models, followed by a forward stepwise logistic regression, were used to determine factors associated with the presence of undiagnosed DM and prediabetes. Factors considered were socio-demographics, medical history, lifestyle characteristics and cardiovascular risk factors. Goodness-of-fit of logistic regression model was assessed by the Hosmer–Lemeshow test. All significance tests were two-tailed and used 5% as the nominal level of significance. All statistical analyses were conducted by the SPSS 18.0 for Windows (SPSS, IBM Inc., Chicago, IL, USA).

3. Results

3.1. Characteristics of study subjects

Among the 3482 Chinese professional drivers who responded to the invitation and attended the clinics from May 2007 to May 2010, 81 did not meet the study admission criteria, and another 25 were excluded either because of incomplete questionnaire or refusal of blood taking. A total of 3376 professional drivers, predominantly male (92.6%), completed the baseline study. Equal proportions of them came from the three different regions of Hong Kong, namely Hong Kong Island, Kowloon and the New Territories. Their basal characteristics were shown in Table 1. Female drivers were younger, had lower BMI and blood pressure than male drivers.