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5-Year longitudinal study of determinants of glycemic control for multi-ethnic Asian patients with type 2 diabetes mellitus managed in primary care

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ABSTRACT

Aim: This study aims to determine the risk factors associated with glycaemic control of ambulatory patients with type 2 diabetes mellitus (T2DM) who are managed in primary care.
Method: The data was retrieved from a primary care site within the Singapore Consortium of Cohort Studies-Diabetes Cohort (SCCS-DC). Demographic and clinical variables were described, in association with the risk of having a deteriorating glycaemic control (defined as an absolute increase of at least 1% HbA1c from one year to a subsequent year). Next, multivariate model was performed to define the independent effect of each factor. The longitudinal analysis of the HbA1c was performed using Generalised Estimating Equation (GEE).
Results: The 5 year longitudinal data of 1256 patients (54% Chinese, 25% Malays, 12% Indians, 9% others) were analysed. Their mean HbA1c decreased by <0.1% in the initial 3 years, but increased thereafter. 12% of them had absolute HbA1c increment of ≥1% in the first year, and 22% over 5 years. Based on GEE analysis, insulin, was associated with an increase of HbA1c (≥1%) from one year to another (all $p < 0.05$). Compared with Chinese patients, Malays had higher HbA1c (+0.3%), Indians (+0.3%), and others (+0.2%), (all $p < 0.01$). Patients with retinopathy had higher HbA1c (+0.2%) and those with cataract had lower mean HbA1c (−0.2%) ($p < 0.01$).
Conclusion: Most cohort patients achieved glycaemic control within the initial 3 years. Patients of Malay and Indian ethnicity and those with retinopathy were associated with subsequent risk of glycaemic control deterioration. Those with cataract were associated with trend towards improved glycaemic control.

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1. Introduction

Singapore has a population of 5.8 million, which is rapidly ageing with an increasing prevalence of type 2 diabetes mellitus (T2DM) [1]. Nonetheless, it ranks globally as fourth in terms of longevity, even as 11.3% of its adult population has T2DM [2]. As 15% of the Singaporeans are expected to have T2DM by 2050 [3], better understanding of the factors affecting their glycaemic control becomes crucial. Maintaining their glycaemic control is critical to avert various macro- and microvascular complications, leading to reduction of diabetic related morbidity and mortality. However, achieving optimal glycaemic control over time becomes challenging for most patients with T2DM as a result of natural decline in beta-cell function [4]. Aside from disease progression, patients' drug treatment, self-management behaviour and access to healthcare services can affect their glycaemic control [5]. Some of these factors are modifiable and present windows of opportunities for interventions to control their hyperglycaemia.

The majority of patients with T2DM in Singapore are being managed in the dual public and private primary healthcare system [6]. SingHealth Polyclinics (SHP) is a local primary care institution comprising of one of two clusters of primary care clinics (polyclinics), which manage more than 1.7 million patient attendances in 2014. It is part of the public fee-for-service primary healthcare system, which offers subsidised consultation to ambulatory patients. Selected medications in specific formulary are dispensed at subsidised rates directly via in-house pharmacy services. With accessibility and affordability at these primary care sites, the Singapore National Health Survey shows that 45% of patients with T2D are managed in the 18 polyclinics alone [7]. As a major primary healthcare provider, the clinical outcomes of patients who are managed at these polyclinics will provide an invaluable insight into their glycemic control and their associated risk factors.

Previous studies had shown that younger age and Malay ethnicity were risk factors for poor glycaemic control in patients with T2DM. The association between the trend in glycaemic control and patient's treatment with various oral medications has yet to be examined for the local patients with T2DM. The choice of oral pharmacotherapy is a factor which is amenable to review and modification by primary healthcare professionals, and potentially can impact on patient's glycaemic control.

This longitudinal study thus aims to determine the factors associated with declining glycaemic control of patients with T2DM over a period of five years within a defined district in Singapore. The results of the study will help to identify modifiable factors, which will allow primary healthcare professionals to intervene to retard the deterioration of their patients' glycaemic control.

2. Materials and methods

2.1. Study site

The study site is a typical polyclinic within SingHealth Polyclinics. Located in the north-eastern Singapore, it caters to the primary healthcare needs of residents in Pasir Ris town, which covers an area of 15 square km with a population of 133,863, comprising of Chinese (67%), Malay (20%), Indians (8%) and others (5%) [10]. The polyclinic patient information system at this study site shows that 4991 multi-ethnic T2DM patients were being managed in 2013 (unpublished data). It is a primary care study site within the Singapore Consortium of Cohort Studies Diabetes Cohort (SCCS-DC) study [11]. The SCCS-DC study was initiated in January 2006 in 5 hospital specialist outpatient clinics, and subsequently extended to 3 polyclinics in Singapore to track clinical outcomes of T2DM patients who are managed in primary care [11]. The study commenced patient recruitment at the polyclinic in Pasir Ris in 2007.

2.2. Subjects

The subjects were adult patients with diagnosis of T2DM as verified from medical records, irrespective of their glycaemic control, co-morbidities and existing complications. They were followed up at the study site for minimally 2 years, with at least one prior glycated haemoglobin level (HbA1c) to assess pre-enrolment diabetic control. The subjects were managed with usual diabetic care based on local clinical practice guidelines. Glycaemic control and blood pressure measurements are routinely assessed every 3–6 months at the study site according to its standard of usual care. At recruitment, their baseline data was captured via an interview with a research coordinator. Subjects with cognitive impairment and those who would not be followed up at the designated polyclinic were excluded.

2.3. Sources of data

The patients' medical records and polyclinic patient information system were the sources of the data. In addition to baseline data captured upon enrolment, retrospective data was retrieved for at least 2 years or longer from the patients' medical records. Earliest clinical data in the database are dated back to 2004. Baseline data include diagnosis details, clinical data such as weight and blood pressure measurements, laboratory investigations such as glycated haemoglobin (HbA1c), lipid profile, renal and liver function tests. Details of specific drug therapy were also collected at enrolment. Subsequent serial data from 2007 till December 2013, such as HbA1c and blood pressure measurements for the study population were updated from medical records and polyclinic patient information system by a research assistant. The institution embarked on electronic health records in 2009, which facilitated this data retrieval.

The retrospective data collected on enrolment was combined with subsequent data collected after enrolment. Thus the combined data of enrolled patients, including their clinical, laboratory and prescription data, could span over 5 years or longer. However the complete first 5 years of longitudinal data for this cohort of patients were used for analysis.

The SCCS-DC cohort study was approved by SingHealth Centralised Institution Review Board (#2007/085/C).