Original Research

Influence of educational attainments on long term glucose control and morbid events in patients with type 2 diabetes receiving integrated care from 15 China urban communities: The Beijing Community Diabetes Study 11

Guang-Ran Yang[a], Shen-Yuan Yuan[a,*], Han-Jing Fu[a], Gang Wan[b],
Liang-Xiang Zhu[a], Ming-Xia Yuan[a], Yu-Jie Lv[c], Jian-Dong Zhang[d],
Xue-Ping Du[e], Yu-Ling Li[f], Yu Ji[g], Li Zhou[h], Yue Li[i], Beijing Community
Diabetes Study Group

[a] Department of Endocrinology, Beijing Tongren Hospital, Capital Medical University, Beijing, China
[b] Department of Medical Records and Statistics, Beijing Ditan Hospital, Capital Medical University, Beijing, China
[c] Cuigezhuang Community Health Service Center, Beijing, China
[d] Jinsong Community Health Service Center, Beijing, China
[e] Yuetan Community Health Service Center of Fuxing Hospital, Capital Medical University, Beijing, China
[f] Xinjiekou Community Health Service Center, Beijing, China
[g] Department of Endocrinology, Beijing Aerospace General Hospital, Beijing, China
[h] School Hospital of Central University for Nationalities, Beijing, China
[i] Aerospace Central Hospital, Beijing, China

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ABSTRACT

Aim: To investigate the effects of educational attainment on glucose control and morbid events in patients with type 2 diabetes in Beijing communities.

Methods: In this prospective multi-center study, 2866 type 2 diabetes patients receiving integrated care from 15 Beijing urban communities were investigated. Educational attainment was categorized into three levels: low, medium, and high. After a 42-month management, glucose control parameters and morbid events were analyzed.

Results: At baseline, the percentages of patients with good glucose control (HbA1c ≤ 7.0%) in the low, medium and high educational groups were 49.09%, 54.82% and 62.59%, respectively ($P < 0.001$). After the 42-month management, fasting plasma glucose and HbA1c values were the highest in the low educational group (7.51 ± 2.05 mmol/l and 7.20 ± 1.27%, respectively). Percentages of patients with good glucose control in the three groups were 49.6%, 55.83% and 67.23%, respectively, and the incidences of combined morbid events were 4.5%, 2.4%

* *Corresponding author at*: Department of Endocrinology, Beijing Tongren Hospital, Capital Medical University, No. 1 Dongjiaomin Xiang, Dongcheng District, Beijing 100730, China. Tel.: +86 1058268466; fax: +86 10 58268466.
E-mail address: fulvic@126.com (S.-Y. Yuan).

and 1.5%, respectively. Cox regression analysis showed that educational level was related to the incidence of combined morbid events (medium level, HR = 0.572; high level, HR = 0.351; $P < 0.05$).

Conclusions: Educational level was associated with long-term glucose control, and seemed to be related to the incidence of combined morbid events in people with type 2 diabetes.

1. Introduction

A considerable number of studies have shown that a low socioeconomic status, which is often measured as a combination of education, income and occupation, is associated with disease, and socioeconomic inequalities in morbidity and mortality are highlighted as key concerns in many countries [1–4]. A correlation between health quality and socioeconomic status has been reported in patients with diabetes mellitus [5]. Several studies have shown an inverse relationship between socioeconomic status and the prevalence of type 2 diabetes and its established risk factors [6–9].

Education as a socioeconomic measure is most widely used in epidemiological studies. Those with less education are at increased risk of developing diabetes, and after diagnosis, exhibit poorer treatment adherence, worse glucose control, and higher rates of diabetic complications [10]. However, one study found that there is no difference in the risk of diabetes complications among different social groups [11].

Currently, the number of people diagnosed with diabetes in China is the highest in the world [12]. However, little is known about the relationship between educational attainment and glucose control in people with type 2 diabetes. There is lack of studies of long-term effects of integrated care on glucose control in type 2 diabetes in Chinese communities. The aim of this study (the Beijing Community Diabetes Study [BCDS] 11) was to examine the potential influence of educational attainment which was used as an indicator of socioeconomic status on glucose control and morbid events following a 42-month integrated care in people with type 2 diabetes living in Beijing communities.

2. Methods

Fifteen community health centers in Beijing were selected by a multistage random sampling method. People with type 2 diabetes (aged 20–80 years) who had lived in the community over 5 years were recruited to the study between August 2008 and July 2009. The 15 community health centers were: Cuigezhuang, Jinsong, Yuetan, Ping'an, 711, Minzu, 721, Sanlitun, Dongfeng, Sijiqing, Jiangtai, Balizhuang, Chongwen, Zuojiazhuang and Majiapu. A total of 2866 diabetic patients from these communities were available for analysis. People with severe disabilities, hepatic failure, renal failure or schizophrenia were excluded.

The study was approved by the Ethics Committee of Beijing Tongren Hospital, Capital Medical University, and was conducted in accordance with the provisions of the declaration of Helsinki. Written informed consent was obtained from all participants. The patients were all followed for a period of 42 months.

2.1. Integrated care

Details of the design, methods, and population of the Beijing Community Diabetes Study (BCDS) have been published previously [13]. In this study, standard protocols with reorganized workflow, treatment targets and regular follow-up were developed in line with chronic care model [14] and the *Chinese Guideline for Type 2 Diabetes* [15] to deliver integrated care. The main components of integrated care included a collaborative team consisting of tertiary hospital specialists and community general practitioners (GPs), regular follow-up visits by physicians for medication adjustments (≥4 times/year), individualized diabetes self-management education by GPs and laboratory measurements.

Treatment targets were defined as follows: (1) hemoglobin A1c (HbA1c) <7%, (2) Fasting plasma glucose (FPG) <7.2 mmol/l, (3) blood pressure <130/80 mmHg, (4) low-density lipoprotein cholesterol (LDL-C) <2.6 mmol/l.

All the patients were seen by a collaborative team every 3 months and more often if indicated. At baseline and each clinic visit thereafter, a physical examination that included anthropometric and blood pressure measurements and laboratory measurements were performed according to the protocol. HbA1c was measured every 3 months, and the lipid profile every 6 months. Measurements of the urinary albumin excretion rate (UAER) and fundus examinations were performed annually. All laboratory results were available for review by a physician at the scheduled visit for decision making. Medication adjustment strategies were performed in accordance with the *Chinese guideline for Type 2 Diabetes* [15]. Treatment compliance and self-care including drug use, insulin injection, self-monitoring of blood glucose, and lifestyle modification were reinforced by GPs during clinic visits, based on individualized assessment of body mass index, occupation, activities and metabolic goals.

A preprinted case report book was used to collect patients' demographic characteristics, medical history, history of pharmacological treatment, assessments items, etc. Blood pressure was measured twice after each subject had been seated for 10 min, and the average value was used for analysis. Fasting glucose and lipid profiles were measured using an autoanalyzer in local laboratories. HbA1c was tested using a Bio-Rad VARIANT hemoglobin analyzer. An 8-h overnight urine collection was performed to measure UAER. Nonstereoscopic 45° photographs of the central fundus were taken in all eyes (Camera CR-DGi; Canon Inc., Tokyo, Japan). The fundus photographs were examined in a masked manner by an experienced ophthalmologist. In cases of doubt,