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# A seven-year study on an integrated hospital-community diabetes management program in Chinese patients with diabetes

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ABSTRACT

*Aims:* To assess whether an integrated hospital-community diabetes management program could improve major cardiovascular risk factor control among patients with diabetes in real-world clinical settings.

*Methods:* 985 adults with diabetes in the Shanghai Taopu community health service center were enrolled at baseline and 907 subjects completed the follow-up. The follow-up levels of the metabolic profiles were assessed by their averages during the follow up period.

*Results:* After a mean 7-year follow-up period, heamoglobin A1c, systolic and diastolic blood pressure levels decreased by 0.6%, 5.7 mmHg, and 1.5 mmHg, respectively (all $P < 0.001$). There was a non-significant difference in low-density lipoprotein cholesterol, while high-density lipoprotein cholesterol increased 1.9 mg/dL and triglycerides decreased 28.3 mg/dL, respectively (all $P < 0.001$). The percentage of patients with diabetes who met any one of three Chinese Diabetes Society goals (heamoglobin A1c <7.0%, blood pressure <140/80 mmHg, and low-density lipoprotein cholesterol <100 mg/dL) increased from 58.2% to 70.1%. The chronic diabetes complication screening rates (diabetic retinopathy, diabetic neuropathy, diabetic nephropathy) have significantly increased, from almost zero to 12–78%.

*Abbreviations:* CDS, Chinese Diabetes Society; HbA1c, haemoglobin A1c; LDL-C, low-density lipoprotein cholesterol; FPG, fasting plasma glucose; HDL-C, high-density lipoprotein cholesterol; SCr, serum creatinine levels; eGFR, estimated glomerular filtration rate; RCTs, randomized controlled trials.

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*Conclusions:* This long-term program has increased the proportions of attaining major cardiovascular risk factors control goals and diabetic chronic complication screening rates among patients with diabetes.



## 1. Introduction

The rapid increase in the prevalence of diabetes has been one of the largest global public health emergencies of the 21st century worldwide [1]. Growing urbanization and obesogenic lifestyle changes have brought this problem to China as well [2]. Much of the burden of diabetes is attributable to microvascular and macrovascular complications, such as diabetic retinopathy, diabetic neuropathy, diabetic nephropathy, and diabetic vasculopathy [1]. Optimal management of blood glucose, blood pressure, and blood lipid profiles can substantially reduce these diabetic complications [3–5]. Major international and national associations, such as the American Diabetes Association, International Diabetes Federation, and Chinese Diabetes Society (CDS), have set treatment targets for haemoglobin A1c (HbA1c), blood pressure, and low-density lipoprotein cholesterol (LDL-C), referred to as the "ABC" targets among patients with diabetes [1,6–8]. However, many studies have suggested that there were still great strides to be taken to reach gratifying attainment rates for these "ABC" targets [9–11].

Previous studies have demonstrated that glycemic control is difficult to achieve for patients with diabetes in China and other Asian countries [12–14]. The International Diabetes Mellitus Practice Study, a 5-year survey documenting changes in diabetes treatment practice in developing regions, revealed that only 20–30% of patients achieved the goal of HbA1c <7% [15]. Another large survey, conducted among the Chinese population with diabetes, showed that less than one third of the patients achieved the goal of HbA1c <7% [16]. Moreover, very few studies in China have assessed the long-term effect of community diabetes management programs on cardiovascular risk factors control among patients with diabetes. The aim of the present study was to assess whether an integrated hospital-community diabetes management program could improve major cardiovascular risk factors control among patients with diabetes in real-world clinical settings.

## 2. Materials and methods

Hospitals in Shanghai as well as other places of China are organized according to a 3-tier system that recognizes a hospital's ability to provide medical care, medical education, and conduct medical research. Based on this, hospitals are designated as Primary, Secondary or Tertiary institutions. A primary hospital is typically a township/street-level hospital, such as the community health service center in our study, and provides preventive care, minimal health care and rehabilitation services. Secondary hospitals tend to be affiliated with their districts and are responsible for providing comprehensive health services, as well as medical education and conducting research on a regional basis. Tertiary hospitals round up the list as comprehensive or general hospitals at the city or national level.

### 2.1. *Shanghai integrated hospital-community diabetes management program (Shanghai hierarchical system for diabetes prevention and control pilot program)*

In 2007, the Shanghai Sixth People's Hospital (a tertiary comprehensive hospital) piloted a project, the integrated hospital-community diabetes management program, to optimize management of patients with diabetes in Shanghai communities according to the 2007 and later CDS Standards of Medical Care in Diabetes. To facilitate this project, different levels of medical services, hierarchical management, and two-way referrals for patients with diabetes between the comprehensive hospitals (the highest level: tertiary hospitals, Shanghai Sixth People's Hospital; the intermediate level: secondary hospitals, Shanghai Putuo District Central Hospital and Shanghai Putuo District Liqun Hospital) and primary hospitals including four Shanghai community health service centers (the lowest level: primary hospitals, Caoyang, Zhenru, Taopu, and Anting community health service centers) were developed. The Shanghai Sixth People's Hospital arranged endocrinologists and nurses to hold regular training classes to improve community physicians' and nurses' theoretical knowledge about standardized diagnosis and treatment of diabetes, and screening and treatment of diabetic complications [17]. Meanwhile, the comprehensive hospitals provided sustainable technical support and a referral platform for intractable cases. If patients have uncontrolled glucose levels or severe complications, they will be promptly referred to the comprehensive hospital for treatment; once their condition has stabilized, they will return to the community health service center for further treatment and recovery.

An information system was developed by the Shanghai Sixth People's Hospital to assist community medical staff in collecting and documenting patients' information. Administrative, anthropometric, laboratory (test code, test collection date, test result values, and abnormal flag), clinical diagnosis, and medication data were collected and input by trained nurses into the system each time patients visited the community health service centers.

Shanghai Taopu community health service center is a primary hospital located in an urban-rural integration area, which serves about 80 thousand residents. In 2007, Taopu community health service center joined this program and a team consisting of two trained, full-time physicians and a trained, full-time nurse at this community health service center started managing patients with diabetes in May, 2008. The team would be responsible for treating and caring for about 1000 patients with diabetes in the next 7 years. Draw-

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