



A survey on the quality of standardized diabetes management in primary care facilities



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ABSTRACT

Background: The rising incidence of diabetes has led China to prioritize the management of type 2 diabetes within community health services. However, there remain gaps in standardized diabetes management in primary care facilities, particularly in terms of quality and capacity.

Objective: This study aims to evaluate the current status of diabetes management and provide a systematic quality assessment. Recommendations for improvement are proposed based on identified issues.

Methods: In May 2022, a survey was conducted involving 249 community health centers of Shanghai. A simple random sampling method was used to select 3,875 general practitioners (GPs), representing 50 % of the registered GPs at each center. Data were collected using a self-designed questionnaire.

Results: All community health centers of Shanghai were able to conduct HbA1c tests; however, screening for diabetic complications was insufficient, with only 16.9 % offering nerve conduction velocity tests. The availability of oral hypoglycemic agents was relatively comprehensive, but insulin options were limited, with only 7.6 % of centers had novel GLP-1 available. Furthermore, only 57.4 % of centers had diabetes specialty clinics. GPs demonstrated strong adherence to diabetes management guidelines but had significant knowledge gaps in medication use, with correct responses regarding oral hypoglycemic agents at 27.9 % and insulin at 29.0 %. GPs tended to transfer new patients with high blood glucose or confirmed diabetic nephropathy to higher-level hospitals.

Conclusion: The infrastructure, equipment, and medications for diabetes management in Shanghai's community health centers partially meet basic quality standards, but there are significant gaps in GPs' knowledge of diabetes medications. To improve diabetes management, efforts should focus on expanding complication screening, increasing the availability of novel hypoglycemic agents and insulin types, enhancing the development of diabetes specialty clinics, and providing GPs with further training to improve their diagnostic and treatment capabilities.

In recent years, with China's aging population and changes in lifestyle, the prevalence of diabetes has been steadily increasing. The prevalence of diabetes rose from 0.67 % in 1980 to 10.4 % in 2013, with an estimated 113.9 million adults living with diabetes and another 493.4 million in the prediabetes stage.¹ Poor long-term blood glucose control among diabetes patients not only results in noticeable clinical

symptoms but can also lead to various complications that severely diminish the quality of life.²

In response to the growing challenges of diabetes management, China incorporated type 2 diabetes management into its basic public health services in 2009. Under this system, general practitioner teams provide comprehensive, continuous, targeted, and proactive health

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management for diabetes patients.³ In 2019, the *Opinions of the State Council on Implementing the Healthy China Initiative* outlined a diabetes prevention and treatment plan, officially integrating standardized diabetes management into the National Health Strategy.⁴ Ensuring the quality of diabetes management in primary care facilities is crucial to the success of the "Healthy China" strategy. However, shortcomings still exist in the standardized management of diabetes in primary care facilities,⁵ indicating an urgent need to improve the quality and capacity of diabetes care.⁶

Based on the need for standardized diabetes management in primary care facilities, this study conducted a survey to investigate the current state of diabetes management in community health centers of Shanghai. The goal was to gain a deeper understanding of the diagnostic and treatment capabilities of these community health centers, assess GPs' practices in diabetes management, and the challenges they face, so as to offer targeted recommendations for optimizing diabetes care, aiming to enhance the effectiveness of diabetes management and improve the clinical quality of care provided by GPs.

Subjects and methods

Subjects of the study

The survey was conducted in May 2022 and involved two main participant groups: (1) Community health centers: A total of 249 community health centers across all 16 administrative districts in Shanghai; (2) GPs: A simple random sampling method was used to select 3875 GPs, representing 50 % of the registered GPs in the community health centers.

Questionnaire design

The research team developed the questionnaire based on the *Chinese Guidelines for the Prevention and Treatment of Type 2 Diabetes (2020)*,¹ *National Guidelines for Primary Care Diabetes Prevention and Management (2022)*,⁷ and *Primary Care Guidelines for the Treatment of Type 2 Diabetes (2019)*.⁸ Two types of questionnaires were designed: one for primary care facilities and the another for GPs.

(1) Institutional questionnaire: This covered diabetes-related tests and examinations available at community health centers, the availability of diabetes treatment medications, diabetes management training in primary care, the establishment of diabetes specialty clinics, and the maintenance of standardized diabetes diagnosis and treatment records.

(2) General practitioner questionnaire: This focused on standardized diabetes diagnosis and management practices, knowledge of diabetes treatment guidelines, and the challenges in implementing standardized diabetes management. The questionnaire included multiple-choice questions and a knowledge evaluation scoring system (with a maximum score of 10, where higher scores indicated a greater level of knowledge).

Survey implementation

The survey questionnaires were distributed through the Quality Control Network of the Shanghai Clinical Quality Control Center for General Practice. To ensure a high response rate, the Quality Control Secretariat collaborated with quality control liaisons at each community health center for point-to-point distribution and collection. The questionnaires were distributed online using the Wenjuanxing platform and conducted in two rounds. In the first round, 249 questionnaires related to diabetes management in community health centers were distributed, and all 249 were collected, achieving a 100 % response rate. In the second round, 3875 questionnaires were distributed to GPs focusing on standardized diabetes diagnosis and management, with 3874 collected, resulting in a 99.97 % response rate. The survey results were exported in Excel format.

Table 1
Implementation of diabetes diagnostic and examination services in community health centers.

Examination item	Number of centers	Percentage (%)
HbA1c	249	100.0
Urine protein/Creatinine ratio or microalbumin	189	75.9
Fundus photography	130	52.2
Continuous glucose monitoring	113	45.4
Glomerular filtration rate	83	33.3
Nerve conduction velocity	42	16.9

Table 2
Availability of diabetes treatment medications in community health centers.

Medication	Number of centers	Percentage (%)
Various oral hypoglycemic agents	192–245	77.1–98.4
Mealtime insulin	181	72.7
Premixed insulin	201	80.7
Other insulins	39–79	15.7–31.7
GLP-1 agonists	19	7.6

Table 3
Diabetes management training in community health centers.

Training method	Number of centers	Percentage (%)
Participation in academic conferences or training programs	234	94.0
Internal lectures	229	92.0
Self-study	199	79.9
Attending diabetes teaching clinics at higher-level hospitals	9	3.6
Advanced training at higher-level hospitals	3	1.2

Statistical methods

The collected data were statistically analyzed using SPSS 25.0 software. Measurement data were described using the mean and standard deviation, while categorical data were summarized with frequency and composition ratios. Both the means and composition ratios were ranked based on their values.

Results

Status of diabetes management in community health centers

All community health centers are capable of conducting HbA1c tests to assess blood glucose control in diabetes patients. However, only 45.4 % of the centers provided continuous glucose monitoring services. Additionally, 75.9 % of the centers can test for urine protein/creatinine ratio or microalbumin, while only 33.3 % offered glomerular filtration rate tests. Furthermore, only 16.9 % conduct nerve conduction velocity tests (see Table 1). The variety of oral hypoglycemic agents in community service centers is relatively comprehensive, covering most categories. However, insulin options are limited, with 72.7 % of centers supplying mealtime insulin and 80.7 % supplying premixed insulin. Only 7.6 % of centers have novel hypoglycemic agents, such as GLP-1 receptor agonists (see Table 2). Over 90 % of community health centers conduct diabetes management training through internal lectures, academic conferences, or training courses. Approximately 80 % require doctors to engage in self-study of diabetes guidelines. However, there are fewer opportunities for physicians to receive advanced training or participate in diabetes clinics at higher-level hospitals (see Table 3). A total of 57.4 % of community health centers have established diabetes specialty clinics, and 77.1 % have set up standard records for diabetes management and treatment (see Table 4).

Table 4

Establishment of diabetes specialty clinics and standardized diabetes management records in community health centers.

Clinic and records	Number of centers	Percentage (%)
Establishment of diabetes specialty clinics	143	57.4
Establishment of standardized diabetes management records	192	77.1

Table 5

Main diabetes management measures by GPs.

Management measure	Number of centers	Percentage (%)
Lifestyle interventions	3394	87.6
Recommending insulin and explaining its pros and cons	2820	72.8
Directly suggesting referral to the endocrinology department	2414	62.3
Providing oral medication treatment	2100	54.2

Table 6

Main management measures for diabetic nephropathy by GPs.

Management measure	Number of centers	Percentage (%)
Identifying and discontinuing medications that may affect kidney function	3607	93.1
Strictly controlling blood pressure	3529	91.1
Adjusting diabetes treatment plan and strictly controlling blood glucose	3475	89.7
Controlling uric acid levels	3332	86.0
Controlling blood lipids	3250	83.9
Direct referral to higher-level hospital	2193	56.6

Current status of standardized diabetes diagnosis and management by GPs

For newly diagnosed diabetes patients or those with previously managed diabetes showing HbA1c levels of $\geq 9.0\%$ or fasting blood glucose of ≥ 11.1 mmol/L, 62.3% of GPs preferred to refer these patients directly to specialized departments in higher-level hospitals, in addition to providing lifestyle interventions, recommending insulin, or prescribing oral hypoglycemic agents (see Table 5). When patients are diagnosed with diabetic nephropathy, 56.6% of GPs favor direct referral to specialized departments—alongside identifying and discontinuing medications that might impair kidney function, strictly controlling underlying conditions, and adjusting diabetes treatment plans (see Table 6). Additionally, over 90% of GPs provided health education to diabetes patients on topics such as diet and exercise (see Table 7).

Based on the diabetes management knowledge assessment scale mentioned earlier, the vast majority of GPs recognized the importance of standardized diabetes management, with an average score of $9.38 \pm$

1.18. Most GPs rated lifestyle guidance, comprehensive blood glucose management, and screening for diabetes complications as highly important in treating type 2 diabetes, with average scores exceeding 9 (see Table 8). While 91.1% of GPs demonstrated good knowledge in identifying, diagnosing, and referring diabetes patients, their understanding of diabetes medications was less adequate. The correct rates for knowledge of oral hypoglycemic agents and insulin use were only 27.9% and 29.0%, respectively. Similarly, their knowledge of screening for diabetic complications was insufficient, with a correct rate of just 49.3% (see Table 9).

This study assessed the challenges faced by GPs in diabetes diagnosis and treatment through self-evaluation. A total of 71% of GPs identified insufficient knowledge of new diabetes medications as the primary challenge (see Table 6). In terms of actual diabetes management, in addition to issues related to patient compliance, GPs noted major challenges in areas such as insufficient diagnostic equipment and the incomplete availability of treatment medications (see Table 10).

Discussion

Diabetes, as one of the most common chronic diseases, is primarily managed by community health centers, which serve as the "front line" in its prevention and treatment.⁷ According to the *Primary Care Guidelines for the Treatment of Type 2 Diabetes (2019)*,⁸ primary care facilities are responsible for the screening, diagnosis, treatment, and long-term follow-up of type 2 diabetes, establishing management records for diabetes patients, and providing tertiary prevention services. Given the critical role these facilities play in the long-term management of diabetes,⁹ it is essential to focus on the quality of diabetes management in primary care facilities. A systematic approach should be adopted to evaluate how well both institutions and GPs adhere to standardized diagnostic and treatment practices, with a view toward continuous improvement.

Quality of standardized management of diabetes in primary care facilities

In healthcare quality management, foundational elements include providing the necessary diagnostic and treatment equipment, medications, appropriate facilities, and training to enhance diagnostic and treatment capabilities.¹⁰ According to the results of this study, the infrastructure, equipment, and medications available for diabetes management in Shanghai's community health centers generally meet the required quality standards. This is consistent with findings from previous research by Sun et al.¹¹

However, community health centers still face limitations in providing comprehensive screening for diabetes complications, particularly in the detection of kidney, retinal, and nervous system complications. Essential screening tests, such as glomerular filtration rate (GFR), fundus photography, and visual conduction tests are generally not available in primary care. This finding aligns with the results of Li Kuo et al.,¹² who

Table 7

Health education provided by GPs to diabetes patients.

Health education content	Yes		No	
	Number of centers	Percentage (%)	Number of centers	Percentage (%)
Portion control of staple foods, with a balance of whole grains and refined grains	3853	99.5	21	0.5
Reducing intake of refined carbohydrates	3846	99.3	28	0.7
Reducing alcohol and sugary drink consumption	3861	99.7	13	0.3
Eating at regular times and in controlled portions, maintaining a moderate eating pace	3816	98.5	58	1.5
Developing the habit of eating vegetables before staple foods	3566	92.0	308	8.0
Engaging in moderate-intensity physical exercise (increased heart rate and breathing without shortness of breath)	3566	94.0	233	6.0
Exercising at least 150 min per week	3702	95.6	172	4.4
Forms of exercise, such as brisk walking, cycling, or Tai Chi	3781	97.6	93	2.4

Table 8
Awareness of GPs on standardized diabetes management.

Category	10 Points		0–9 Points		Average Score
	Number of centers	Percentage (%)	Number of centers	Percentage (%)	
Importance of standardized diabetes management	2721	70.2	1153	29.8	9.38±1.18
Helping patients with a reasonable diet	3068	79.2	806	20.8	9.60±0.99
Helping patients exercise regularly	2776	71.7	1098	28.3	9.42±1.14
Helping patients manage weight	2770	71.5	1104	28.5	9.43±1.13
Helping patients quit smoking	2579	66.6	1295	33.4	9.21±1.41
Helping patients regularly monitor blood glucose	3037	78.4	837	21.6	9.59±0.97
Educating patients on foot care	2372	61.2	1502	38.8	9.03±1.56
Annual fundus examination for patients	2618	67.6	1256	32.4	9.24±1.39
Monitoring kidney function for patients	2791	72.0	1083	28.0	9.44±1.11
Assessing patients for peripheral nerve damage	2606	67.3	1268	32.7	9.30±1.26
Helping patients control blood pressure	2965	76.5	909	23.5	9.56±0.97
Helping patients control blood lipids	2929	75.6	945	24.4	9.52±1.06
Prescribing aspirin for high-risk patients	2243	57.9	1631	42.1	8.84±1.82

Table 9
Understanding of GPs regarding primary care guidelines for diabetes diagnosis and treatment.

Questionnaire Item	Number of questions	Total responses	Correct responses	Correct rate (%)
Knowledge of diabetes identification, diagnosis, and referral	4	15,496	14,115	91.1
Knowledge of oral hypoglycemic agents	3	11,622	3244	27.9
Knowledge of insulin use	3	11,622	3373	29.0
Knowledge of screening for diabetic complications	3	11,622	5730	49.3

Table 10
Evaluation of challenges faced by GPs in standardized diabetes diagnosis and treatment.

Questionnaire item	Number of responses	Percentage (%)
What challenges do you face in diabetes diagnosis and treatment? (Multiple choices)		
Lack of knowledge of novel hypoglycemic agents	2750	71.0
Inadequate ability to choose and combine oral hypoglycemic agents	1910	49.3
Insufficient ability to assess patients' high-risk factors	1820	47.0
Hesitance to use insulin	2363	46.1
Inadequate ability to set diabetes control targets	1503	38.8
Lack of confidence in diagnosing diabetes subtypes	1143	29.5
What challenges do you face in the actual management of diabetes? (Multiple choices)		
Poor patient compliance	3235	83.5
Insufficient diagnostic and examination equipment	2867	74.0
Incomplete availability of treatment medications	2537	65.5
Limited consultation time	1995	51.5
Lack of pathways for bidirectional referrals with higher-level hospitals	1519	39.2
Insufficient ability to provide diabetes health education	1445	37.3

also identified similar gaps in primary care facilities in Nanjing, indicating that the current screening services at these centers fall short of addressing the full spectrum of diabetes-related complications. In addition, the variety of insulin available at community health centers remains limited. This is consistent with the findings of Xiang Lan et al.,¹³ who observed that in one community health center in Shanghai, pre-mixed insulin accounted for 97 % of the total insulin expenditure. This may explain why GPs lack sufficient experience with insulin, often referring patients requiring insulin therapy to higher-level hospitals. Another significant issue is the limited availability of novel antidiabetic medications. Although Li Pan et al.¹⁴ noted that the use of novel antidiabetic agents is not restricted by the hospital level, only a few community health centers stock GLP-1 receptor agonists. This limitation hinders diabetes patients' access to these novel treatment options, making it more difficult for them to benefit from the latest advancements in diabetes care.

Additionally, the training opportunities offered by community health centers are relatively limited, with few chances for GPs to pursue advanced clinical training at higher-level hospitals. This reduces their opportunities for professional clinical guidance, limiting their ability to improve their clinical skills.¹⁵ While 77.1 % of community health centers have established standard records for diabetes management, the quality of the records is often compromised by excessive copying and

pasting, resulting in low content quality.¹⁶ Currently, 57.4 % of community health centers have set up diabetes specialty clinics, but further efforts are needed to strengthen these clinics to better guide patients in managing their blood glucose and improving self-management skills.¹⁷

Main measures implemented by GPs for standardized diabetes management and screening and prevention of complications

Community GPs play a pivotal role in the standardized management of diabetes in primary care facilities. Their level of professional expertise and adherence to clinical guidelines directly influence both the progression of diabetes and the effectiveness of complication control. By consistently following the latest guidelines, GPs ensure comprehensive and standardized management of diabetes patients, which is critical for ensuring effective diabetes care in primary care facilities.

The *Chinese Guidelines for the Prevention and Treatment of Type 2 Diabetes (2020)*.¹ emphasize that the scientific and rational treatment of type 2 diabetes is comprehensive, including blood glucose control, lipid regulation, weight control, and lifestyle modifications. This survey revealed that all GPs can provide lifestyle guidance to diabetes patients, prescribe antidiabetic medications or insulin, and transfer patients to endocrinology specialists when necessary. CHEN's¹⁸ research demonstrated that lifestyle interventions can effectively lower blood glucose

and blood pressure, improve lipid profiles, and reduce body weight in diabetes patients.

The *National Guidelines for Primary Care Diabetes Prevention and Management (2022)*.⁷ recommend that type 2 diabetes patients undergo at least one annual screening for complications after diagnosis. However, statistics show.¹⁹ that only 54 % of diabetes patients at large municipal hospitals in China have received fundus examination, and only 36 % have undergone screening for neurological and limb complications. The proportion of diabetes patients who have been screened for chronic complications in primary care facilities is even lower. According to the results of this survey, GPs had insufficient knowledge regarding the screening of diabetes complications, which may be a contributing factor to the low screening rates.

Diabetic nephropathy requires comprehensive management, including lifestyle interventions, risk management, and medication treatment.²⁰ This survey showed that 56.6 % of GPs preferred to transfer diabetic nephropathy patients directly to specialists at higher-level hospitals, likely due to a lack of specialized knowledge regarding its treatment. Similarly, the study by YANG et al.²¹ revealed that the overall accuracy rate of GPs' knowledge related to diabetic nephropathy in Shanghai was approximately 60 %, while the accuracy rate for management-related knowledge was only 35.5 %, highlighting a deficiency in effective management practices for diabetic nephropathy.

GPs' knowledge of diabetes management in community health centers

This survey revealed that GPs demonstrated a strong understanding of standardized diabetes diagnosis and management, with a correct rate of 91.1 %. However, their knowledge of oral hypoglycemic agents and insulin was insufficient, with correct rates of only 27.9 % and 29.0 %, respectively. JIA et al.²² found that 72 % of GPs lacked sufficient professional knowledge, indicating that this is a widespread issue. One possible explanation for this is the recent shift in community health services towards general practice, where GPs tend to prioritize health education and lifestyle guidance over specialized knowledge in diabetes diagnosis and treatment. This shift may have contributed to the relative deficiency in specialized knowledge compared to higher-level hospitals.²³

Challenges in standardized diabetes management in community health centers

This survey highlighted several challenges identified by GPs, including insufficient knowledge and skills related to diabetes management and poor patient compliance. To address these issues, it is crucial to advance the development of subspecialties within community-based general practice. This would enable GPs to extend their services into specific subspecialties for targeted populations,²⁴ thereby providing higher-quality diagnosis, treatment, and management services for specific patient groups.

Measures to improve standardized diabetes management in community health centers

The quality of chronic disease management is shaped by various factors, including institutional capabilities, physicians' knowledge, and clinical practices. A comprehensive analysis and identification of these factors are crucial for developing effective strategies for improvement. Based on the results of this study, several important measures to enhance diabetes management quality in community health centers are as follows: (1)Continuously improving the infrastructure and equipment of community health centers, adding more equipment for screening and testing diabetic complications and expanding the availability of new antidiabetic medications and insulin options.²⁵ (2)Focusing on enhancing the knowledge of GPs, particularly their skills in managing diabetic complications. This can be achieved through multi-tiered training programs, including flexible online platforms, sending key personnel for advanced

training at higher-level hospitals, and offering opportunities to participate in diabetes teaching clinics. Increasing knowledge exchange opportunities will help GPs improve their diagnostic and treatment capabilities and ensure adherence to standardized practices.²⁶ (3)Strengthening the development of specialized diabetes clinics to provide continuous, refined management for diabetes patients. Personalized health education can improve patients' health literacy, encourage lifestyle changes, and lead to better long-term outcomes and quality of life for diabetes patients.²⁷

The limitations of this study stem from the design of the questionnaire

For example, we focused solely on assessing the current state of diabetes management within community health centers, without assessing the effectiveness of community-based diabetes management from the patients' perspective. Additionally, various factors may have prevented GPs from accurately reflecting the true situation when completing the survey. In future research, our team will aim to address these limitations by refining both the questionnaire design and the scope of the investigation.

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Authors' contributions

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All authors declare that there are no competing interests.

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