


# BMJ Open Nationwide survey of physicians' familiarity and awareness of diabetes guidelines in China: a cross-sectional study

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## ABSTRACT

**Objective** This study aims to investigate physicians' familiarity and awareness of four diabetes guidelines and their practice of the recommendations outlined in these guidelines.

**Design** A cross-sectional study.

**Setting** An online questionnaire survey was conducted among physicians affiliated with the Specialist Committee for Primary Diabetes Care of China Association of Chinese Medicine, using the snowball sampling method to ensure a broader representation of physicians.

**Participants** 1150 physicians from 192 cities across 30 provinces in China provided complete data.

**Results** Tertiary care hospital physicians (TCPs) exhibited the highest familiarity with the Guideline for the Prevention and Treatment of Type 2 Diabetes Mellitus in China (91.3%), followed by the National Guidelines for the Prevention and Control of Diabetes in Primary Care (76.8%), the Standards of Medical Care in Diabetes (72.2%) and the Guidelines for Prevention and Treatment of Diabetes in Chinese Medicine (63.8%). Primary care practitioners (PCPs) exhibited familiarity with these four guidelines at about 50% or less. Self-reported reference to modern diabetes guidelines by physicians is more frequent than traditional Chinese medicine (TCM) diabetes guidelines, with rates at 73.2% and 33.8%, respectively. Approximately 90% of physicians provided instructions on self-monitoring of blood glucose to their patients with diabetes. Less than one-third of physicians referred patients to a specialised nutritionist. In terms of health education management, TCPs reported having a diabetes health management team at the rate of 75.7%, followed by secondary care hospital physicians at 57.0% and PCPs at 27.5%. Furthermore, approximately 40% of physicians did not fully grasp hypoglycaemia characteristics.

**Conclusions** Familiarity and awareness of the screening guidelines varied among physicians in different hospital settings. Importantly, significant discrepancies were observed between physicians' awareness and their self-reported reference to modern medicine guidelines and TCM guidelines. It is essential to consistently provide education and training on diabetes management for all physicians, particularly PCPs.

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This nationwide questionnaire survey involved 1150 physicians from hospitals of different levels in China, aiming to analyse the differences in familiarity and awareness of both Chinese and international diabetes guidelines among different physician groups. The results provided nationally representative evidence regarding physicians' familiarity and awareness of these guidelines.
- ⇒ Apart from the self-reported familiarity and reference questionnaire items, our study also identified several facilitating factors and barriers to the implementation of diabetes guidelines among different physician groups.
- ⇒ Although we have included multiple-choice questions to gather more comprehensive information, we acknowledge that the survey questionnaire may not cover all specific aspects related to physicians' awareness of the diabetes guidelines.

## INTRODUCTION

Diabetes is a metabolic disorder caused by the interplay of genetic and environmental factors, which has become a critical global health concern worldwide due to its high prevalence and associated disability and mortality rates.<sup>1,2</sup> According to the latest data published by the International Diabetes Federation, an estimated 537 million adults worldwide have been diagnosed with diabetes.<sup>3</sup> China currently bears the highest burden of diabetes globally, with approximately 141 million individuals living with the disease aged between 20 and 79 years. Moreover, it is predicted that the number of diabetes cases in China will continue to grow significantly.<sup>4</sup> However, recent national data on chronic diseases and their risk factors in China indicate that awareness, treatment and control rates for diabetes were 36.7%, 32.9% and 50.1%, respectively, which have not changed significantly since



2013.<sup>5 6</sup> Therefore, addressing this substantial public health issue is crucial, with the objective of enhancing the national diabetes awareness rate, treatment rate and control rate.

Clinical practice guidelines (CPGs) are statements that facilitate optimal disease management for health professionals and patients. However, to ensure effective implementation and adherence to guidelines, it is crucial to enhance health professionals' familiarity and awareness of CPGs.<sup>7</sup> Previous studies have emphasised the significance of physician awareness in the successful adoption of cardiovascular disease prevention guidelines, asthma guidelines, chronic kidney disease guidelines, etc.<sup>8–10</sup> A systematic review identified lack of physician awareness and familiarity with guidelines as the primary factors contributing to deviation from recommended therapy.<sup>11</sup> Notably, a cross-sectional study highlighted that physicians' lack of knowledge and patients' unawareness of guidelines could account for about 70% of non-adherence.<sup>12</sup> Therefore, emphasising physicians' familiarity and awareness of clinical guidelines is essential for optimising patient management.

Modern medicine, with strategies such as insulin injections and oral medications such as metformin, is vital for managing diabetes. However, the effectiveness of these methods is not always absolute and they are not consistently well tolerated.<sup>13</sup> The full potential of managing type 2 diabetes mellitus (T2DM) side effects, discomfort and complications with Western medicine alone has not yet been realised. Traditional Chinese medicine (TCM) methods may be a potentially complementary approach, given the relatively minor side effects of natural herbs, non-drug therapies and external treatment.<sup>14</sup> Previous studies have reported that TCM therapies are beneficial for the comprehensive prevention and treatment of diabetes, particularly when combined with Western medicine, where it can play a significant role in enhancing effectiveness. Studies showed TCM therapies used in conjunction with Western medicine can potentially not only improve clinical outcomes (such as weight loss, self-reported symptoms and glucose metabolism), but also reduce medicinal dosages and delay diabetes progression.<sup>15 16</sup> For example, the use of TCM in conjunction with Western medicine can alleviate discomforts from drugs, such as bloating induced by acarbose.<sup>17</sup> Additionally, diabetic peripheral neuropathy characterised by sensations of coolness, numbness and limb pain, an integrated approach using specific TCM prescriptions, such as Buyang Huanwu Decoction and Danggui Sini Decoction, as well as external treatments like herbal foot baths, can significantly enhance therapy's effectiveness.<sup>18</sup> Therefore, specific TCM measures were suggested as adjuvant therapy for individuals with diabetes in a wide range of clinical research studies. Furthermore, the TCM treatment measures for diabetes (including the integration of TCM into the comprehensive treatment of diabetes, alleviating patient-reported symptoms, preventing or alleviating complications, TCM non-drug therapies and

external treatments, etc) are recommended as adjuvant therapies for diabetes prevention and treatment in the 'Guideline for the Prevention and Treatment of T2DM in China (2020)' and the 'National Guidelines for the Prevention and Control of Diabetes in Primary Care (2022)'.<sup>19 20</sup>

To effectively enhance the prevention and standardised management of diabetes mellitus, a series of clinical guideline documents have been released both domestically and internationally. Including annually updated Standards of Medical Care in Diabetes issued by the American Diabetes Association since 1994. This is one of the diabetes guidelines that is widely recognised internationally.<sup>21</sup> China has been publishing its first 'Clinical Diabetes Guidelines in China' since 2000, which are updated on average every 3 years. The most recent update is Guideline for the Prevention and Treatment of T2DM in China (2020) issued by Chinese Diabetes Society (CDS).<sup>19</sup> Additionally, the 'National Guidelines for the Prevention and Control of Diabetes in Primary Care (2018)' was published for the first time in 2018, and it was updated in 2022.<sup>20</sup> Notably, the first diabetes guideline within the field of TCM, 'Guidelines for Prevention and Treatment of Diabetes in Chinese Medicine', issued by China Association of Chinese Medicine (CACM) in 2007.<sup>22</sup> In China, the recommendations for the treatment of diabetes by Western medicine combined with Chinese medicine mainly refer to these four guidelines. Therefore, the four guidelines mentioned above are considered as the screening guidelines investigated in this study. To provide nationally representative evidence regarding the familiarity and awareness of physicians with diabetes guidelines in China, we conducted a nationwide survey to compare physicians' awareness, self-reported reference status and practice of different diabetes guidelines. Additionally, we examined the differences among physicians from hospitals at different levels. Furthermore, the facilitating factors and barriers to the implementation of diabetes guidelines among different physician groups were identified in this study.

## RESEARCH DESIGN AND METHODS

### Survey design

This is an investigator-initiated, non-commercial survey of physicians at various levels of hospitals in China. This work was conducted by the Specialist Committee for Primary Diabetes Care of CACM, a national academic institution. A majority of physicians who are members of the specialist committee participated in the survey questionnaire. The questionnaire was distributed electronically to the participants, and electronic written informed consent from respondents was required before proceeding with the survey. Additionally, participants were requested to assist in forwarding the questionnaire to other general practitioners, physicians and experts using the snowball sampling method. In the overall design of this survey, we aimed to ensure a broader representation of respondents

by recruiting physicians from different grades of hospitals in China, including tertiary to primary medical institutions. Additionally, the endocrinology diabetes specialists, general practitioners and TCM physicians were mainly recruited.

### Questionnaire and pretest

A questionnaire comprising four sections was established with a total of 42 items. Section I assessed participants' clinical background and basic demographic data. Section II evaluated participants' familiarity with and self-reported reference status regarding various diabetes guidelines, presented as single-choice questions in the form of Likert scales. Section III examined participants' awareness and practice of specific measures outlined in diabetes guidelines, accompanied by a list of guideline-based recommendations provided in online supplemental appendix 1. The guideline action statements were rephrased as options in both single-choice and multiple-choice formats, enabling respondents to choose the most appropriate answers. Lastly, section IV investigated the facilitating factors and barriers during the process of guideline implementation.

The questionnaire underwent a pilot test involving 24 physicians from Fujian and Gansu provinces in China from 20 August 2021 to 27 August 2021. Additionally, experts familiar with these diabetes guidelines were invited to evaluate the contents of the questionnaire. Subsequently, the questionnaire was optimised based on feedback received during the pilot survey and expert consultation meeting.

### Sample and administration

The sample size calculation was completed in accordance with the cross-sectional survey formula  $N = (Z_{\alpha}^2 \times pq) / (d^2)$ .<sup>23</sup> According to a literature search, the estimated value of  $p$  is 26.2% (the projected rate of Chinese physicians being very familiar with the diabetes guidelines),  $q = 1 - p$  and  $d = 0.1 \times p$ . Assuming a 5% two-tailed type I error ( $Z_{\alpha} = 1.96$ ) and a two-sided 95% confidence level, the estimated result of  $N$  was 1082. The investigation was performed from 22 September 2021 to 29 October 2021, a total of 1162 participants completed the survey. The logical discrepancies or potential errors found in the questionnaires were resolved through telephone communication with the respondents.

### Statistical analysis

Statistics analysis was performed by using SAS V.9.4. Continuous variables were presented as means with  $\pm$ SDs, and categorical variables as counts ( $n$ ) and percentages (%). Pearson's  $\chi^2$  test was used to compare categorical variables, and the Wilcoxon rank-sum test was used for non-parametric numerical variables. Moreover, the Cochran-Mantel-Haenszel test was used for ordinal categorical variables. Differences in guidelines familiarity and awareness among

different physician groups, including tertiary care hospital physicians (TCPs), secondary care hospital physicians (SCPs) and primary care practitioners (PCPs), were analysed. In this study, the percentage differences among groups were reported, with statistically significant differences indicated by  $p < 0.05$ .

### Patient and public involvement

Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

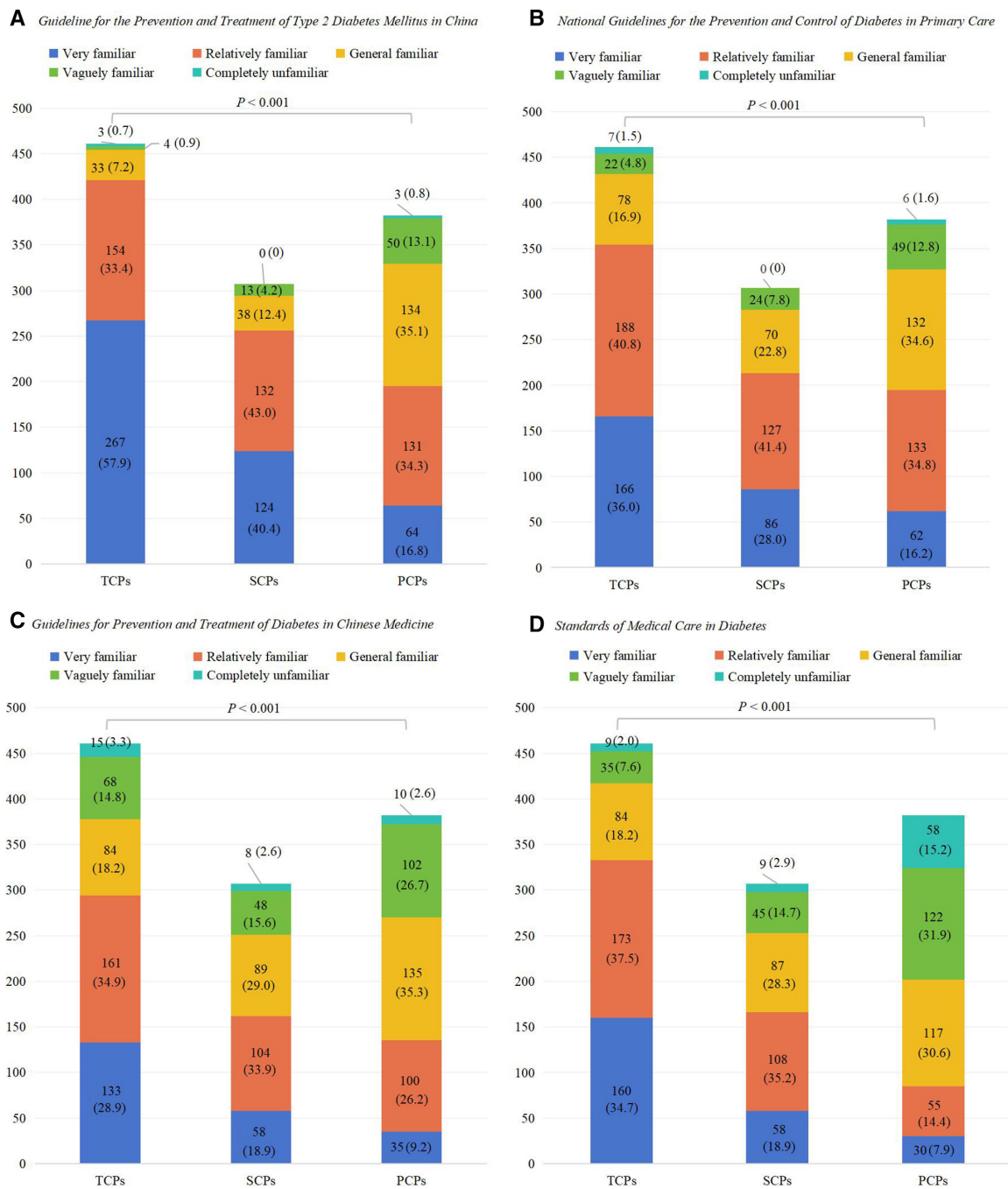
## RESULTS

### Sample characteristics

A total of 1162 questionnaires were collected. Among these, we finally included 1150 questionnaires (99.0%) from physicians after excluding 12 questionnaires (7 from nurses, 2 from pharmacists and 3 from medical teachers). Among the included questionnaires, 461 (40.1%) were obtained from TCPs, 307 (26.7%) were obtained from SCPs and 382 (33.2%) were obtained from PCPs. There were significant differences among the three groups of physicians in terms of gender, educational level, professional category, years in practice, technical title, diabetes practice setting and number of patients with diabetes treated per week ( $p < 0.05$ ). The full characteristics of the physicians are presented in online supplemental appendix 1.

### Physicians' familiarity with diabetes guidelines

Physicians' familiarity with diabetes guidelines is demonstrated in figure 1. In the overall sample, the rankings of familiarity (including both very familiar and relatively familiar) with the four guidelines were as follows: Guideline for the Prevention and Treatment of Type 2 Diabetes Mellitus in China (75.8%), National Guidelines for the Prevention and Control of Diabetes in Primary Care (66.3%), Guidelines for Prevention and Treatment of Diabetes in Chinese Medicine (51.4%) and Standards of Medical Care in Diabetes (50.8%). TCPs exhibited a higher likelihood of familiarity with these four guidelines compared with other groups. Particularly, TCPs demonstrated the highest familiarity with the Guideline for the Prevention and Treatment of Type 2 Diabetes Mellitus in China (91.3%), followed by SCPs (83.4%), and PCPs (51.0%) ( $p < 0.001$ ). Similarly, TCPs exhibited a higher level of familiarity (76.8%) with the National Guidelines for the Prevention and Control of Diabetes in Primary Care compared with SCPs (69.4%) and PCPs (51.1%) ( $p < 0.001$ ). In terms of the Guidelines for Prevention and Treatment of Diabetes in Chinese Medicine, TCPs exhibited the highest level of familiarity (72.2%), followed by SCPs (52.8%), and PCPs (35.3%) ( $p < 0.001$ ). Lastly, various degrees of familiarities with the Standards of Medical Care in Diabetes



**Figure 1** Familiarity of physicians from different levels of hospitals with four diabetes guidelines. PCPs, primary care practitioners; SCPs, secondary care hospital physicians; TCPs, tertiary care hospital physicians.

were observed among TCPs (63.8%), SCPs (54.1%) and PCPs (22.3%) ( $p < 0.001$ ).

### Physicians' self-reported reference status of diabetes guidelines

Physicians' self-reported reference status of diabetes guidelines summarised in [table 1](#). In terms of modern medicine guidelines, the rates of 'frequent reference' were 80.9%, 77.2% and 60.7% for TCPs, SCPs and PCPs, respectively, indicating a stronger compliance in TCPs group ( $p < 0.001$ ). In comparison, the rates of 'frequent reference' to TCM guidelines were 36.2% for TCPs,

36.5% for SCPs and 28.8% for PCPs, suggesting that the compliance to TCM guidelines was relatively low across all groups. No significant differences about the compliance to TCM guidelines were observed among these three physicians groups ( $p = 0.071$ ).

### Physicians' awareness and practice of contents from diabetes guidelines

The objective of this section is to assess physicians' awareness and practice of the recommendations outlined in the diabetes guidelines. These recommendations encompass various aspects, including dietary management,

**Table 1** Physicians' self-reported reference status of diabetes guidelines (n (%))

Categories	Overall (n=1150)	Physicians in different level hospitals			P value
		Tertiary care hospital physicians (n=461)	Secondary care hospital physicians (n=307)	Primary care practitioners (n=382)	
Modern medicine guidelines*					
Frequent reference	842 (73.2)	373 (80.9)	237 (77.2)	232 (60.7)	<0.001
Occasional reference	236 (20.5)	75 (16.3)	59 (19.2)	102 (26.7)	
Infrequent reference	53 (4.6)	9 (2.0)	8 (2.6)	36 (9.4)	
Rare reference	17 (1.5)	4 (0.9)	3 (1.0)	10 (2.6)	
No reference	2 (0.2)	0 (0.0)	0 (0.0)	2 (0.5)	
TCM guidelines†					
Frequent reference	389 (33.8)	167 (36.2)	112 (36.5)	110 (28.8)	0.071
Occasional reference	459 (39.9)	182 (39.5)	127 (41.4)	150 (39.3)	
Infrequent reference	186 (16.2)	66 (14.3)	41 (13.4)	79 (20.7)	
Rare no reference	89 (7.7)	34 (7.4)	25 (8.1)	30 (7.9)	
No reference	27 (2.4)	12 (2.6)	2 (0.7)	13 (3.4)	

\*Modern medicine guidelines including Standards of Medical Care in Diabetes issued by the American Diabetes Association, Guideline for the Prevention and Treatment of Type 2 Diabetes Mellitus in China and National Guidelines for the Prevention and Control of Diabetes in Primary Care issued by Chinese Diabetes Society.  
 †TCM guidelines including Guidelines for Prevention and Treatment of Diabetes in Chinese Medicine issued by China Association of Chinese Medicine.  
 TCM, traditional Chinese medicine.

physical exercise, self-monitoring of blood glucose (SMBG), health education, hypoglycaemia knowledge, as well as treatment approaches based on TCM differentiation. Detailed information regarding specific recommendations can be found in online supplemental appendix 2.

### Management of diet and physical exercise

In terms of dietary management for patients with diabetes, the proportions of TCPs, SCPs and PCPs choosing 'hand over to a specialised nutritionist or comprehensive management team' were 39.5%, 25.7% and 22.8%, respectively ( $p<0.001$ ). In addition, the proportions of TCPs, SCPs and PCPs choosing 'personally evaluate the nutritional status of patients and provide detailed nutritional treatment suggestions and goals' were 61.4%, 61.6% and 44.0%, respectively ( $p<0.001$ ). It is noteworthy that PCPs had the highest proportions (54%) to choose 'due to the limited consultation time, patients are only given basic dietary advice' compared with TCPs (28.0%) and SCPs (24.4%) ( $p=0.018$ ).

In terms of physical exercise management, the proportions of TCPs, SCPs and PCPs choosing 'hand over to a specialised health manager or professional manager team' were 29.3%, 21.2% and 20.2%, respectively ( $p=0.003$ ). Similarly, the proportions of TCPs, SCPs and PCPs choosing 'personally evaluate the health and athletic ability of patients, then provide detailed exercise recommendations' were 66.6%, 69.7% and 52.9%, respectively ( $p<0.001$ ). Furthermore, regarding the distribution of brochures, the preference ranked from highest

to lowest as follows: SCPs (67.8%), PCPs (65.5%) and TCPs (56.0%) ( $p=0.001$ ). Detailed results are illustrated in [table 2](#).

### Instruction on SMBG and health education management

Physicians' instruction on SMBG and the availability of health management team was also observed. These results revealed that TCPs (96.5%) exhibited the highest rate of SMBG instruction (including both comprehensive guidance and frequent guidance) compared with SCPs (94.5%) and PCPs (88.0%) ( $p<0.001$ ). In terms of health education management, 75.7% of TCPs reported the presence of diabetes health management teams, followed by SCPs (57.0%) and PCPs (27.5%) ( $p<0.001$ ). Detailed results are demonstrated in [figure 2](#).

### Physicians' knowledge of hypoglycaemia identification and TCM differentiation treatment

According to the guideline recommendations (online supplemental appendix 2), the accurate characteristics of hypoglycaemia include options a, b, c and d, as defined in [table 3](#). In our exploratory analysis, the percentages of TCPs, SCPs and PCPs choosing 'a, b, c and d' were 63.6%, 65.2% and 49.5%, respectively. Notably, the accuracy rate of TCPs was higher compared with SCPs and PCPs ( $p<0.001$ ). These results indicate that approximately 40% of physicians may have insufficient understanding of the guideline recommendations on hypoglycaemia. Similarly, the guidelines recommend specific prescriptions for diabetes based on TCM syndrome differentiation (online

**Table 2** Physicians' practice of dietary and exercise recommendations according to diabetes guidelines (n (%))

Categories	Overall (n=1150)	Physicians in different level hospitals			P value
		Tertiary care hospital physicians (n=461)	Secondary care hospital physicians (n=307)	Primary care practitioners (n=382)	
Dietary management					
Hand over to a specialised nutritionist or comprehensive management team	348 (30.3)	182 (39.5)	79 (25.7)	87 (22.8)	<0.001
Personally evaluate the nutritional status of patients and provide detailed nutritional treatment suggestions and goals	640 (55.7)	283 (61.4)	189 (61.6)	168 (44.0)	<0.001
Advise patients to follow specific dietary patterns, for example, the Mediterranean diet, a low-fat and low-energy diet	626 (54.4)	263 (57.1)	163 (53.1)	200 (52.4)	0.340
Distribute brochures	701 (61.0)	265 (57.5)	199 (64.8)	237 (62.0)	0.108
Provide dietary guidance based on the TCM principle of food and medicine sharing the same source	546 (47.5)	208 (45.1)	147 (47.9)	191 (50.0)	0.364
Due to the limited consultation time, patients are only given basic dietary advice	334 (29.0)	129 (28.0)	75 (24.4)	130 (54.0)	0.018
Physical exercise management					
Hand over to a specialised health manager or professional manager team	277 (24.1)	135 (29.3)	65 (21.2)	77 (20.2)	0.003
Personally evaluate the health and athletic ability of patients, then provide detailed exercise recommendations	723 (62.9)	307 (66.6)	214 (69.7)	202 (52.9)	<0.001
For patients with frequent hypoglycaemia, increase physical exercise and improve physical fitness	453 (39.4)	161 (34.9)	120 (39.1)	172 (45.0)	0.011
Distribute brochures	716 (62.3)	258 (56.0)	208 (67.8)	250 (65.5)	0.001
Guidance on TCM physical exercises, such as Tai $\chi$ and Baduanjin	539 (46.9)	207 (44.9)	152 (49.5)	180 (47.1)	0.452
Due to the limited consultation time, patients are only advised to exercise regularly	389 (33.8)	158 (34.3)	97 (31.6)	134 (35.1)	0.609
TCM, traditional Chinese medicine.					

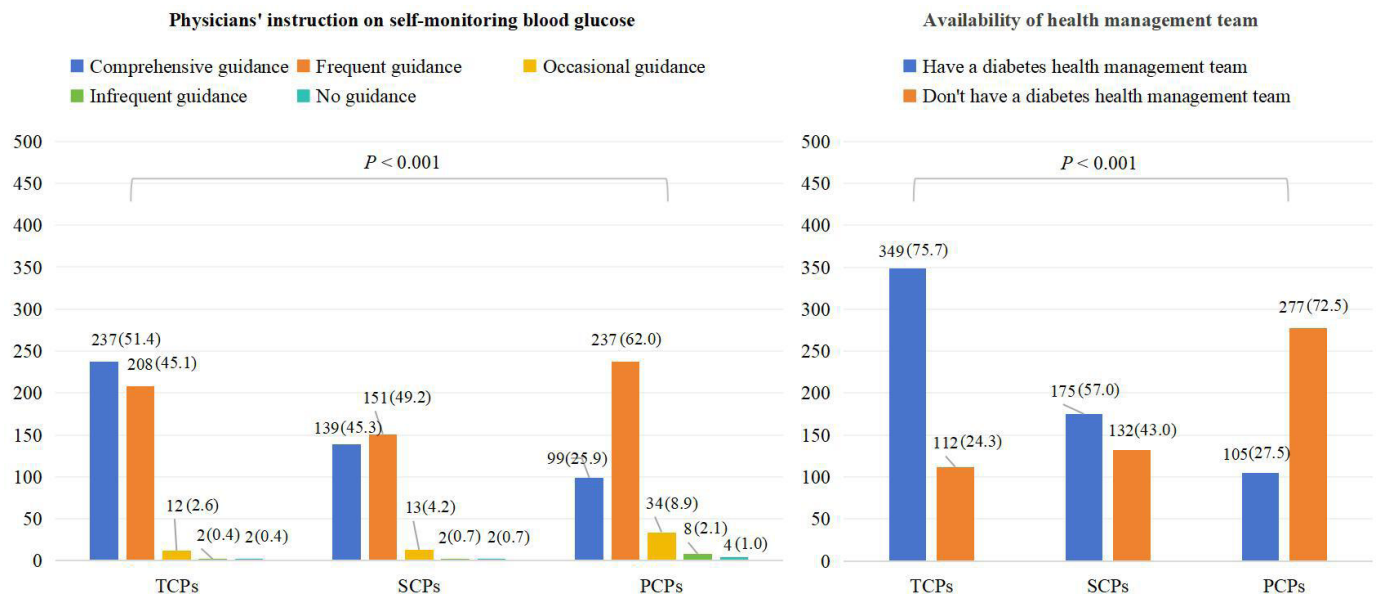
supplemental appendix 2). For diabetes with Qi-Yin deficiency syndrome, prescriptions including options a, b and c in table 3 are indicated. The accuracy rates of TCPs, SCPs and PCPs were 86.1%, 86.3% and 83.5%, respectively, showing no significant differences among these three groups of physicians ( $p=0.477$ ). When considering diabetic neuropathy with Qi-deficiency and collateral-obstruction syndrome, interventions or prescriptions based on this syndrome differentiation involve options a, b and c as outlined in table 3 based on the guidelines. The accuracy rate was higher for TCPs (68.6%) than for SCPs (65.8%) and PCPs (55.0%) ( $p<0.001$ ).

#### Facilitating factors and barriers to implementation of diabetes guidelines

Standardising clinical practices, guiding patients' self-care and the presence of high-level evidence were consistently considered as the top three facilitating factors for adherence to diabetes guidelines across the majority of physicians (see online supplemental appendix 3). The

majority of physicians, regardless of their level of hospital, concur on the pivotal role of guidelines in standardising their clinical practices and improving medical quality, with no significant differences observed among the three groups (TCPs=96.1%, SCPs=97.1%, PCPs=94.0%,  $p=0.118$ ). Importantly, approximately 80% of physicians in all the groups acknowledged the potential of diabetes guidelines in guiding patients' nursing practices. Notably, a statistical difference was observed among physicians from different levels of hospitals regarding their preference for 'guidelines with a high-level of evidence that can be convincing' (TCPs=71.8%, SCPs=67.4%, PCPs=46.1%,  $p<0.001$ ). This finding suggests that TCPs are more inclined towards evidence-based recommendations than SCPs and PCPs.

In terms of barriers to the implementation of diabetes guidelines, the majority of physicians from different-level hospitals chose 'limited availability and accessibility of TCM diabetes guidelines' as a major obstacle (TCPs=68.8%,



**Figure 2** Physicians' instruction on self-monitoring of blood glucose and the availability of health management team. PCPs, primary care practitioners; SCPs, secondary care hospital physicians; TCPs, tertiary care hospital physicians.

SCPs=68.7%, PCPs=61.5%,  $p=0.050$ ), with no significant difference observed among the three groups. Additionally, 'time-consuming communication with patients' was identified as the second most prevalent barrier to the implementation of diabetes guidelines, with the selection rates ranking highest to lowest as follows: PCPs (65.5%), SCPs (59.9%) and TCPs (52.5%) ( $p=0.001$ ). Lastly, in line with the pattern displayed by the facilitating factors, physicians from different levels of hospitals showed a statistically significant difference in selecting 'the guideline recommendation lacks a convincing basis' (TCPs=29.3%, SCPs=22.8%, PCPs=18.6%,  $p=0.001$ ).

## DISCUSSION

This national survey of 1150 physicians aimed to investigate their familiarity and awareness of four different diabetes guidelines. Two main findings were revealed from this nationwide survey. First of all, the level of familiarity and self-reported reference status with the diabetes guidelines varied among clinicians in hospitals at different levels. Second, a significant discrepancy was observed between physicians' awareness of modern medicine guidelines and TCM guidelines. Overall, TCPs exhibited the highest awareness of the diabetes guidelines, followed by SCPs and PCPs. These findings are in line with several previous studies that have reported relatively poor attitudes and adherence to guidelines among general practitioners and PCPs compared with other medical doctors.<sup>24 25</sup> These differences may be attributed to the additional training in diabetes management received by physicians in tertiary hospitals compared with PCPs.<sup>26</sup>

Additionally, the results indicated that the rate of physicians' self-reported reference for modern medical guidelines was approximately twice of that for TCM guidelines. This discrepancy may be attributed to several factors.

First, modern medical guidelines, such as Guideline for the Prevention and Treatment of Type 2 Diabetes Mellitus in China issued by the CDS, are based on a larger body of high level evidence from modern medicine, making them crucial for guiding clinical practice in China.<sup>27</sup> In contrast, the establishment of TCM guidelines is relatively recent with limited availability of high-level evidence. Moreover, the complex nature of TCM syndrome differentiation and TCM physicians' heavy reliance on clinical experience may further worsen the discrepancy.<sup>28 29</sup> Therefore, it is necessary to provide training and guidance on health management for diabetes to physicians, especially PCPs. Future studies should focus on further exploration and in-depth research of TCM diabetes guidelines.

Regarding physicians' knowledge of specific recommendations from diabetes guidelines, our study revealed that the majority of physicians instruct patients to conduct SMBG. However, recent national data indicate that there has been no significant improvement in the awareness, treatment and control rates of diabetes over the past decade.<sup>5 6</sup> In addition, our study also revealed unsatisfactory management of diet, physical exercise and health education. In terms of diet and physical exercise management, less than one-third of physicians choose to refer to specialised professional management teams. Furthermore, due to time constraints, more than half of PCPs provide only basic dietary advice to patients such as 'paying attention to diet'. However, the guidelines strongly recommend that 'patients with T2DM or pre-diabetes need to receive individualised medical nutrition guidance, which should be conducted under the guidance of nutritionists (physicians) or comprehensive management teams familiar with the nutritional treatment for diabetes'.<sup>19</sup> The results also indicated that PCPs reported a lower rate of assistance by health management team,

**Table 3** Physicians' knowledge of hypoglycaemia identification and TCM differentiation treatment (n (%))

Categories	Overall (n=1150)	Physicians in different level hospitals			P value
		Tertiary care hospital physicians (n=461)	Secondary care hospital physicians (n=307)	Primary care practitioners (n=382)	
The characteristics of hypoglycaemia including:					
a. Blood glucose <3.9mmol/L	1045 (90.9)	409 (88.7)	282 (91.9)	354 (92.7)	0.110
b. Hypoglycaemia without a specific blood glucose limit, accompanied by serious events involving changes in consciousness and/or physical condition	788 (68.5)	336 (72.9)	223 (72.6)	229 (60.0)	<0.001
c. Symptoms of sympathetic excitement such as palpitations, anxiety, sweating, dizziness, hand tremors and feelings of hunger	1124 (97.7)	453 (98.3)	304 (99.0)	367 (96.1)	0.022
d. Central nervous system symptoms such as changes in mental status, cognitive impairment, convulsions and coma	1013 (88.1)	424 (92.0)	289 (94.1)	300 (78.5)	<0.001
Accuracy rate (all above option)	682 (59.3)	293 (63.6)	200 (65.2)	189 (49.5)	<0.001
Prescriptions for diabetes with Qi-Yin deficiency syndrome					
a. Shenqi Jiangtang granule	931 (81.0)	370 (80.3)	256 (83.4)	305 (79.8)	0.443
b. Jinlida granule	507 (44.1)	221 (47.9)	157 (51.1)	129 (33.8)	<0.001
c. Shengmai Powder	616 (53.6)	270 (58.6)	150 (48.9)	196 (51.3)	0.017
d. Gegen Qinlian decoction	143 (12.4)	51 (11.1)	37 (12.1)	55 (14.4)	0.335
e. Dachaihu decoction	63 (5.5)	27 (5.9)	16 (5.2)	20 (5.2)	0.899
Accuracy rate (choosing 'a, b or c' without 'd or e')	981 (85.3)	397 (86.1)	265 (86.3)	319 (83.5)	0.477
Prescriptions or interventions for diabetic neuropathy with Qi-deficiency and collateral-obstruction syndrome					
a. Mudan granule	608 (52.9)	281 (61.0)	170 (55.4)	157 (41.1)	<0.001
b. Acupuncture	510 (44.4)	216 (46.9)	134 (43.7)	160 (41.9)	0.337
c. TCM fumigation	650 (56.5)	282 (61.2)	179 (58.3)	189 (49.5)	0.002
d. Qiming granule	422 (36.7)	145 (31.5)	105 (34.2)	172 (45.0)	<0.001
Accuracy rate (choosing 'a, b or c' without 'd')	728 (63.3)	316 (68.6)	202 (65.8)	210 (55.0)	<0.001

TCM, traditional Chinese medicine.

which is consistent with their lower self-reported rate of choosing to 'hand over to a special professional manager team'. Lastly, our results suggested that some physicians may not have mastered the content of the guidelines well enough, as evidenced by approximately 40% of physicians providing inaccurate or omitted judgement about the characteristics of hypoglycaemia. These data suggest a significant disparity between clinical practice and guidelines, which is consistent with previous studies.<sup>30</sup>

Therefore, it is necessary to provide physicians with more specific training and guidance on diabetes health management, and it is imperative to further enhance the allocation of diabetes-related professional personnel and teams in primary medical institutions.

Similar to findings from other studies, our study also identified several facilitating factors and barriers to the implementation of diabetes guidelines.<sup>31 32</sup> Regarding the facilitating factors for the implementation of diabetes



guidelines, most physicians believe that guidelines can standardise clinical practice, improve medical quality and guide patients in self-care. This indicates that the significance of guidelines is recognised by the majority of physicians.<sup>33</sup> Although our study provides important insights into facilitating factors in the implementation of guidelines, some barriers to guideline implementation must be considered. Our results indicate that limited availability and accessibility of TCM diabetes guidelines are major barriers. Indeed, previous studies have shown that TCM guidelines have been established relatively recently, indicating that further investigation focusing on the TCM diabetes guidelines should be required.<sup>26</sup> Meanwhile, it is essential to publish these guidelines on multiple platforms, including freely accessible ones, so that all physicians can download and study them. In addition, consistent with previous studies, PCPs demonstrated less awareness about the latest evidence, in contrast to TCPs. Research conducted by Carlsen highlighted that general practitioners are often confused about the evidence base of extensive guidelines relevant to their practice and they experience more practical constraints on guideline implementation.<sup>24</sup> Therefore, while it is crucial to prioritise high-level evidence to improve the reliability of these guidelines, equal emphasis should also be placed on training of PCPs.

### Strengths and limitations

This study has several strengths. First, this questionnaire survey was nationally representative and provided reliable data on the physicians' familiarity and awareness of both Chinese and international diabetes guidelines. Our analysis sample included physicians from different medical institutions across 192 cities in 30 provinces of China, which is highly representative. Second, we conducted a stratified analysis approach to obtain more specific and comprehensive results, including the stratification of physicians in different medical institutions. Third, apart from the self-reported familiarity and reference questionnaire items, we also designed a wide range of specific questions concerning multiple key recommendations within the current guidelines, which will allow us to evaluate the physicians' awareness of contents in the guidelines effectively. Thus, our findings could provide the latest evidence for future studies focusing on diabetes guidelines in China.

Our study also has certain limitations. First, although the sample is representative of Chinese medical physicians and a substantial number of physicians (>1000), the findings cannot be automatically applied to other countries. Second, we have not examined variations regarding awareness of physicians, self-reported reference status of physicians and barriers to treatment among different age, gender, education or number of patients with diabetes received by the physician. Future studies focusing on the influencing factors of physicians' compliance with diabetes guidelines will be conducted. Lastly, although we have included multiple-choice questions to investigate

more information, the survey questionnaire has not been generalisable to test all specific aspects related to the physicians' awareness of the diabetes guidelines.

### CONCLUSION

In conclusion, the level of familiarity and awareness of these four evaluated guidelines varies among physicians in different-level hospitals. Overall, TCPs generally exhibited the highest familiarity and awareness of diabetes guidelines. In contrast, the familiarity and awareness of all four guidelines among PCPs are relatively poor, indicating a necessity of improvement. In addition, there is a significant discrepancy between modern medicine guidelines and TCM guidelines, highlighting the necessity for further studies focusing on TCM diabetes guidelines. Moreover, it is crucial to provide consistent education and training for physicians, in particular, PCPs.

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