ORIGINAL RESEARCH

Understandings, Attitudes, and Barriers About Diabetes Care: Analysis of Factors Influencing Community Pharmacists in China

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Purpose: Diabetes mellitus (DM) has been known as a major chronic health problem in China. Suboptimal management of diabetic patients may incur serious complications, even death. The quality of post-hospital care has a good relationship with community pharmacists. However, data describing the current situation from care between community pharmacists and patients in China are lacking. Our article is to investigate community pharmacists' activities, evaluate their attitudes towards providing diabetes care, assess their understandings, and identify perceived barriers.

Methods: A survey divided into four parts was carried out randomly in China. The part of basic characteristics, understandings, and pharmacists' perceived barriers was rated with a few listed choices scales, while the Likert scale was used to identify on the part of attitudes. Quantitative data were shown in frequency and valid percent. One-way analysis of variance (ANOVA) and non-parametric test conducted on data. A P-value ≤0.05 was considered statistically significant.

Results: A total of 737 surveys were collected. The respondent pharmacists maintained a simply moderate understanding of diabetes care and the pharmaceutical services provided met basic needs rather than clinical ones, though they showed a good momentum towards providing better service. The respondent pharmacists considered patients lacking knowledge on self-management, shortage of funds as the main barriers.

Conclusion: Efforts are supposed to make to expand pharmacists' scope of practice, lessen patients' reluctance, and create platforms for pharmacists receiving further education.

Keywords: diabetes, community pharmacy, general practice, attitudes, barriers

Plain Language Summary

- China has a great population of patients suffering from diabetes mellitus. Community pharmacists still have huge room to play in the community management of diabetic patients. At present, there is insufficient research on community pharmacists for diabetes management, and it is necessary for us to investigate the development status first.

- In this research, we try our best to expand the scope of the investigation to the entire country to make the data sufficiently representative and persuasive. We conducted a comprehensive survey on the quality of community pharmacists, their awareness of diabetes and community disease management, and expectations for the future.

- Community pharmacists still need multiple efforts from themselves and the external society to achieve the desired level of diabetes management. Community pharmacists need to learn more professional knowledge and receive more professional training.

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Diabetic patients need to enter the community more boldly to accept management. Society needs to provide more policy publicity and material support. Of course, community pharmacists as a whole have full confidence in the future of diabetes community management. Community pharmacists in China will have an irreplaceable role in diabetes care sooner or later.

Introduction

It is estimated 451 million people were suffering from diabetes in 2017 compared to 415 million in 2015.[1,2] In China, the latest epidemiological data shows that the prevalence of diabetes among adults is 10.4%.[3] Besides, of all people with diabetes, only 37% have been officially diagnosed and 35.6% are receiving treatment.[4] Less than 35% of the patients treated are effectively controlled for blood glucose.[5] As a chronic disease affecting such a massive population, series of complications and poor adherence to therapy lead to health deterioration and add up to unnecessary expenditures easily, eventually compromising patients' quality of life.[6] According to NDEP National Diabetes Survey: 2016, both the proportion of person with diabetes who lived with hypertension was 40%.[7] Around 50% of patients reported poor adherence to their regimens.[8] In China, more than 70% of person with diabetes die from cardiovascular and cerebrovascular diseases. The overall prevalence of lower extremity arterial disease reported in the certain study was 21.2%.[9] The prevalence of retinopathy and vision-deteriorating retinopathy is 27.9% and 12.6%, respectively.[10] Confronting these urgent matters, community pharmacists are good candidates to continuously support the proper provision of diabetes care outside the institutional setting.[11] Undoubtedly, more and more efforts and positive impacts of pharmacists on improving diabetes or its co-morbidities management have been recognized.[12] Pharmacists can play the following roles in the comprehensive management of diabetic patients, including improving patient medication compliance, ensuring the rationality of patients' home medication, providing medication education for patients, and participating in medication monitoring for diabetic patients.[13–15] Study results from primary literature have shown that the involvement of pharmacists in direct patient care yields additional average HbA1c reductions of 0.88%-1.8%, average systolic blood pressure reductions of 5.7–7.8 mmHg, and average low-density lipoprotein (LDL) reductions of 6.3 mg/dL-18.7 mg/dl, compared with standard care.[16,17] Also, the continuous intervention of the pharmacist is a cost-effective administration method, which improved the quality of life without any increase in spending. Furthermore, spending on controlling the process of illness deterioration was saved at the same time.[18] Pharmacists can also assist in identifying asymptomatic diabetic patients. For example, in all community pharmacies in Thailand, the screening process employed risk prediction tools developed by Aekplakorn to select individuals who are at high risk for capillary blood glucose. Similar screening tools are promoting in Western, Oman, India, Japan.[15]

In China, around 400,000 pharmacists practice in community pharmacies.[4] Not restricted in the traditional model, community pharmacists can also play a significant role in raising community awareness on risk factors and the importance of a healthy lifestyle. The emerging diabetes epidemic represents a significant demand for pharmacists to devote to diabetes care. The study aims to describe Chinese community pharmacists' attitudes and care they routinely provide to patients, to measure their diabetes knowledge, and to assess their perceived barriers. Eventually, results are summarized as references to establish official and standardized systems to evaluate the quality of diabetes care.

Materials and Methods
Study Design and Data Source

From June to July 2019, a survey of a random sample of community pharmacists was conducted randomly in China. Pharmacists working in the community setting were eligible to participate in the study. Respondents covered different regions of China. All participants completed the questionnaire online through a link created by a questionnaire website, the questionnaire star.

In practice, statisticians propose that the sample size should be 5–10 times the scale item. Based on the number of survey items, the questionnaire should include a minimum of 410 people.

Questionnaire Design

The design of the questionnaire mainly refers to Theoretical Domains Framework Version 2 and similar literature previously.[19–21] As seen in the Supplementary Material, the whole questionnaire was divided into four parts.

The first section collected the social-demographic information, including region, educational background, work setting, etc.

The second section examined the pharmacist's understanding of diabetes care by probing the practice frequency of each service. This part consisted of 23 questions measured with a 4-level scale. These questions covered but were not limited to education on patient self-management, services included in routine care, clinical counseling, and monitor of lab tests. These items were listed after a thorough literature review of guidelines and similar studies.[7,20,22–25]

The third section was comprised of 15 potential barriers and the pharmacists were requested to choose the degree of the hindrance. Each of these was measured with a 5-level scale ranging.

The last section evaluated pharmacist's attitudes towards diabetes care on a 5-point Likert scale. For positive events, the choice of strongly agree scores 5 points; for negative events, strongly disagree scores 5 points.

Statistical Analysis

Data were entered into the SPSS, version 23 for analysis. Considering the specificity of certain questions, partially completed surveys were also included in the analysis. In this study, the alpha reliability coefficient method was used to test the reliability of the questionnaire, and the KMO test and Bartley sphere test were used to test the validity. The result of the test in Table 1 shows good reliability and validity. Demographic data were analyzed using frequencies and valid percentages (Table 2). Choices of the other three parts use the same presentation form for descriptive analysis (Tables 3,Tables 4–5). ANOVA and non-parametric test analysis were conducted on four factors related to the categorical data. Statistical significance was accepted at $p < 0.05$.

Results

From June to July 2019, a total of 737 responses were collected. All results were submitted online. And all

Table 1 Test of Reliability and Validity

Alpha Reliability Coefficient	
Cronbach Alpha	0.856
Number of items	63
KMO Test	
KMO measure of sampling adequacy	0.929
Bartley Spheroid Test	
Approximate Chi-square	24,536.018
F	2016
Statistical significance (P)	0.000

Table 2 Characteristics of Participant Pharmacist

Characteristics	N (Valid Percent)
Sex	
Male	87 (11.8%)
Female	648 (88.2%)
Region	
Central	104 (14.1%)
North	63 (8.6%)
East	281 (38.2%)
South	82 (11.2%)
Northwest	89 (12.1%)
Northeast	29 (3.9%)
Southwest	87 (11.8%)
Professional pharmacist	605 (82.8%)
Years of getting a licensed pharmacist certificate	
<5	311 (42.2%)
6–10	188 (25.5%)
11–15	51 (6.9%)
>15	42 (5.7%)
Years of experience as community pharmacists	
<5	192 (26.1%)
6–10	242 (32.8%)
11–15	170 (23.1%)
16–20	83 (11.3%)
>20	48 (6.5%)
Weekly working hours	
<8	71 (9.6%)
8–24	151 (20.5%)
25–40	166 (22.5%)
>41	343 (46.5%)
Major	
Pharmacy	385 (52.2%)
Clinical	94 (12.8%)
Nursing	32 (4.3%)
Traditional Chinese Medicine	159 (21.6%)
Other medicine related majors	67 (9.1%)
Education level	
Specialist (college and secondary school)	438 (69.4%)
Bachelor	291 (39.5%)
Master (above)	7 (0.7%)
Average number of pharmacists in the pharmacy at any one shift	
0	24 (3.3%)
1	408 (55.4%)
>1	293 (39.8%)
Practice setting	
Chain community pharmacy	610 (82.8%)
Independent community pharmacy	31 (4.2%)

(*Continued*)

Table 2 (Continued).

Characteristics	N (Valid Percent)
Public health care ambulatory clinic pharmacy	8 (1.1%)
Private health care ambulatory clinic pharmacy	2 (3%)
Others	84 (11.4%)
Willing to participant in diabetes training and/ or continuing professional education activities	641 (87%)
Interest in receiving diabetes specific training and or continuing professional education activities in the future	702 (95.3%)
Approximate percentage of diabetic patients	
0	4 (0.6%)
10	224 (31.4%)
25	247 (34.6%)
50	167 (23.4%)
75	68 (9.5%)
100	4 (0.6%)
Availability of anti-diabetic medications in the pharmacy	717 (97.3%)
Availability of diabetic supplies and/or supplements in the pharmacy	621 (84.3%)
Set up a patient file	558 (75.7%)

questionnaires have been filled out, and there are no missing answers.

Characteristics of Pharmacists

648 respondents (88.2%) were female. The majority worked in eastern and central regions. Over 600 participants had obtained licenses. 67.7% of them had got licenses in the past decade which was compatible with their work duration. Most participants worked in chain pharmacies, while only about 5% working in independent pharmacies. 46.5% of participants followed a full-time schedule, providing diabetes service weekly for more than 40 hours. 69.4% and 40.2% of participants held a secondary education diploma and a higher education degree, respectively. Most pharmacies were provided with necessary auxiliary diabetes testing devices. 702 respondents (95.3%) planned to receive specialized diabetes training.

Understanding of Diabetes Care

The majority of pharmacists often stressed the importance of a healthy lifestyle and self-monitoring of glucose, which was known as two of the most important recommendations in guidelines.[3] Similarly, educating patients on matters of hypoglycemia was seen in two-thirds of scenarios. Regarding medication counseling, the majority of pharmacists always suggested to patients the appropriate time to take medication and side effects. As a special medication with hypoglycemia risk, insulin requires special guidance. Therefore, the importance of insulin counseling in great detail cannot be emphasized enough. More than two-thirds of pharmacists offered information on the use and storage of insulin. 377 of respondents informed patients of the mechanism of insulin and the key differences amongst formulations. Additionally, Complication management constituted a critical part of the inpatient care process. Around 60% highlighted the importance of screening for nephropathy, retinopathy, and neuropathy. As relevant monitoring parameters, blood pressure and cholesterol targets were emphasized by 84% and 73% of pharmacists respectively. Meanwhile, the percentage of practitioners educating patients on practicing foot care and recommending anti-platelet therapy was smaller only with 53% and 42%. Lastly and unexpectedly, education on the importance of receiving influenza and pneumococcal pneumonia immunization was integrated into practice by less than 35% of pharmacists.

Perceived Barriers for Diabetes Care

The top three perceived barriers for providing diabetes services were patients' lack of knowledge on self-management (70%, n = 516/737), shortage of funding (59.7%, n = 440/737), and inadequacy of professional staff (56.9%, n = 419/737). The low frequency of pharmacy visiting placed a negative impact on service promotion and spread. Having limited access to patients' comprehensive medical profiles and professional training after graduation restrained their ability to provide appropriate service. Last but not least, the absence of specific private counseling areas depressed the ongoing evolution.

Attitudes Towards Diabetes Care

Overall, pharmacists had positive attitudes towards managing diabetes. They supported the need for diabetes care to be popularized, given the serious consequences following complications and medication-related problems. Also, they agreed with community pharmacists taking responsibility for screening pre-diabetic patients and complications and then initiating care as early as possible accordingly. Nearly 90% of practitioners upheld that implementing diabetes management can enhance the recognition and value of this profession in society. Also, the total score presents

Table 3 Understandings of Diabetes Care, Including Daily Activities

Items	Never[a]	Rarely[b]	Often[c]	Always[d]	P[※]
Counsel on the use of blood glucose meters including how to obtain a blood sample and how to interpret results	23 (3.2%)	165 (22.6%)	344 (47.1%)	198 (27.1%)	0.003
Evaluate blood glucose log for values outside target range	81 (11.1%)	291 (40.0%)	264 (36.3%)	91 (12.5%)	0.000
Counsel about signs, symptoms, causes and treatment of hypoglycemia	20 (2.8%)	210 (28.9%)	325 (44.7%)	172 (23.7%)	0.005
Counsel on when to contact the health care provider	11 (1.5%)	167 (23.0%)	365 (50.2%)	184 (25.3%)	0.186
Review the patient's drug refill history to identify poor adherence	32 (4.4%)	245 (33.7%)	332 (45.6%)	119 (16.3%)	0.053
Provide specific interventions to help improve adherence	38 (5.2%)	237 (32.7%)	338 (46.6%)	112 (15.4%)	0.414
Counsel on the appropriate handling and storage of insulin	39 (5.4%)	160 (22.0%)	282 (38.7%)	247 (33.9%)	0.000
Counsel on the appropriate use of insulin pens, syringes, lancets and needles (eg, sharp disposal)	45 (6.2%)	176 (24.1%)	259 (35.5%)	249 (34.2%)	0.000
Counsel on how insulin works and the key differences amongst insulin formulations	72 (9.9%)	279 (38.3%)	247 (33.9%)	130 (17.9%)	0.000
Counsel on appropriate insulin administration (mixing insulin, injection technique, injection time)	51 (7.0%)	200 (27.4%)	280 (38.4%)	198 (27.2%)	0.029
Describe the appropriate time to administer each oral anti-diabetic drug	9 (1.2%)	126 (17.3%)	333 (45.7%)	260 (35.7%)	0.059
Counsel about the side effects of oral anti-diabetic drugs	12 (1.6%)	183 (25.1%)	356 (48.8%)	179 (24.5%)	0.508
Counsel on current recommendations for antiplatelet therapy (eg, low dose Aspirin)	113 (15.6%)	303 (41.8%)	243 (33.5%)	66 (9.1%)	0.181
Provide education on the importance of controlling blood pressure in diabetes	8 (1.1%)	101 (13.9%)	365 (50.1%)	254 (34.9%)	0.808
Discuss the importance of self-testing of blood glucose levels	7 (1.0%)	83 (11.5%)	351 (48.5%)	282 (39.0%)	0.512
Counsel on the current treatment targets for cholesterol in diabetes	28 (3.9%)	160 (22.0%)	333 (45.9%)	205 (28.2%)	0.398
Provide education on the importance of regular screening for retinopathy	48 (6.6%)	244 (33.5%)	293 (40.2%)	143 (19.6%)	0.121
Provide education on the importance of regular screening for nephropathy	42 (5.8%)	232 (31.8%)	316 (43.3%)	139 (19.1%)	0.262
Provide education on the importance of regular screening for neuropathic pain	63 (8.7%)	242 (33.4%)	296 (40.8%)	124 (17.1%)	0.168
Counsel on good foot care techniques	76 (10.5%)	265 (36.5%)	261 (35.9%)	125 (17.2%)	0.666
Provide education about the importance of immunization for influenza and pneumococcal injection time)	170 (23.4%)	299 (41.1%)	180 (24.8%)	78 (10.7%)	0.205
Describe the appropriate time to administer each oral anti-diabetic drug	9 (1.2%)	126 (17.3%)	333 (45.7%)	260 (35.7%)	0.059
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Provide education on the importance of regular screening for neuropathic pain	63 (8.7%)	242 (33.4%)	296 (40.8%)	124 (17.1%)	0.168
Counsel on good foot care techniques	76 (10.5%)	265 (36.5%)	261 (35.9%)	125 (17.2%)	0.666
Provide education about the importance of immunization for influenza and pneumococcal pneumonia	170 (23.4%)	299 (41.1%)	180 (24.8%)	78 (10.7%)	0.205
Stress the importance of weight control in diabetes management where applicable	8 (1.1%)	129 (17.7%)	367 (50.3%)	225 (30.9%)	0.169
Stress the importance of diet and regular exercise in diabetes management	3 (0.4%)	87 (11.9%)	344 (47.2%)	295 (40.5%)	0.659

Notes: [a]This service is not provided to patients with diabetes. [b]This service is provided to about 25% of patients with diabetes. [c]This service is provided to about 75% of patients with diabetes. [d]This service is provided to about 100% of patients with diabetes. [※]Result of $\chi 2$ test, dimensions according to different regions.

a normal distribution with the middle-high, and low sides. The result of the total score expressed a positive attitude and confidence.

Correlation Analysis

To obtain further results, we build one-way analysis and non-parametric test to explore deeper correlation. We

Table 4 Perceived Barriers for Providing Diabetic Care Services

Items	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	P※
Providing chronic management service is not the main KPI of pharmacists	131 (17.9%)	269 (36.7%)	188 (25.5%)	122 (16.7%)	22 (3.0%)	0.456
I do not have enough time	21 (2.8%)	98 (13.3%)	259 (35.1%)	315 (42.7%)	44 (6.0%)	0.007
Shortage of personnel	20 (2.7%)	64 (8.7%)	234 (31.8%)	352 (47.8%)	67 (9.1%)	0.397
I do not have a private counselling area	14 (1.9%)	83 (11.3%)	245 (33.2%)	341 (46.3%)	54 (7.3%)	0.005
Low patient expectations regarding pharmacists role in diabetes	30 (4.1%)	111 (15.1%)	263 (35.7%)	269 (36.5%)	64 (8.7%)	0.167
Lack of diabetes related educational materials in the pharmacy	24 (3.3%)	117 (15.9%)	249 (33.8%)	300 (40.7%)	47 (6.4%)	0.018
Lack of access to patients medical profiles	13 (1.8%)	99 (13.4%)	217 (29.4%)	348 (47.2%)	60 (8.1%)	0.019
Lack of diabetes therapeutic knowledge and skills	20 (2.7%)	116 (15.7%)	275 (37.3%)	288 (39.1%)	38 (5.2%)	0.155
Limited funding	10 (1.4%)	46 (6.2%)	241 (32.7%)	366 (49.7%)	74 (10.0%)	0.122
Cultural or religious barriers	36 (4.9%)	191 (25.9%)	345 (46.8%)	149 (20.2%)	16 (2.2%)	0.567
Lack of diabetic patients visiting the pharmacy	14 (1.9%)	92 (12.5%)	346 (46.9%)	257 (34.9%)	28 (3.8%)	0.119
I am not interested in providing diabetes care	55 (7.5%)	244 (33.1%)	306 (41.5%)	115 (15.6%)	17 (2.3%)	0.006
Language barrier	64 (8.7%)	288 (39.1%)	324 (44%)	55 (7.5%)	6 (0.8%)	0.085
Lack of diabetes training programs for pharmacists	20 (2.7%)	97 (13.2%)	246 (33.4%)	316 (42.9%)	58 (7.9%)	0.002
Low patient knowledge about diabetes management	13 (1.8%)	28 (3.8%)	180 (24.4%)	423 (57.4%)	93 (12.6%)	0.305

Note: ※Result of $\chi 2$ test, dimensions according to different regions.

Table 5 Attitude Towards Diabetic Care

Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	P※
I think the practice of diabetic care is valuable.All patients should be performed pharmaceutical care	222 (30.1%)	345 (46.8%)	147 (19.9%)	19 (2.6%)	4 (0.5%)	0.408
Primary responsibility of pharmacists should be to prevent and solve medication-related problem and complications.	180 (24.4%)	371 (50.3%)	148(20.1%)	32(4.3%)	6(0.8%)	0.022
Providing diabetic care takes too much time and effort	90(12.2%)	327(44.4%)	234(31.8%)	82(11.1%)	4(0.5%)	0.628
Diabetic care is an extensio o the community pharmacy services	181 (24.6%)	458 (62.1%)	86 (11.7%)	11 (1.5%)	1 (0.1%)	0.582
Do you feel that conductingthese eye o foot screenings is a task yo woul be willing to complete on a routine basis?	86 (11.7%)	367 (49.8%)	232 (31.5%)	49 (6.6%)	3 (0.4%)	0.168
Do you think the technology is useful to the patients at this pharmacy?	194 (26.3%)	475 (64.5%)	64 (8.7%)	2 (0.3%)	2 (0.3%)	0.065
What positive aspects, if any, have you noticed about offering this screening in the pharmacy?	112 (15.2%)	414 (56.2%)	190 (25.8%)	13 (1.8%)	8 (1.1%)	0.020
What negative aspects, if any, have you noticed about offering this screening in the pharmacy?	22 (3.0%)	145 (19.7%)	264 (35.8%)	281 (38.1%)	25 (3.4%)	0.941
Pharmaceutical care will increase the patient's appreciation of the pharmacist's value and image	204 (27.7%)	443 (60.1%)	80 (10.9%)	10 (1.4%)	0	0.947
There are no economic benefits to be gained from implementation of pharmaceutical care	21 (2.8%)	107 (14.5%)	226 (30.7%)	326 (44.2%)	57 (7.7%)	0.024

Note: ※Result of $\chi 2$ test, dimensions according to different regions.

divide dimensions according to different regions. Results in detail are shown in Table 6.

Discrepancy of Understandings of Diabetes Mellitus Care

Results of ANOVA show that counselling on how insulin works and differences amongst insulin formulations varies especially in the South and Southwest regions. Also, diabetes mellitus patients' ratio and practice time have an impact on this point more or less. Likewise, pharmacists mostly emphasize the importance of weight control regardless of different regions. Furthermore, combining with non-parametric tests, the following descriptions can be concluded:

Table 6 One-Way Analysis of Variance and Non-Parametric Test **eg**, Divide Dimensions According to Different Regions

Items P value	ANOVA	KW Test	JT Test
Counsel on the use of blood glucose meters including how to obtain a blood sample and how to interpret results		0.009	0.060
Evaluate blood glucose log for values outside target range	0.000		
Evaluate blood glucose log for values outside target range		0.304	0.891
Evaluate blood glucose log for values outside target range		0.268	0.887
Review the patient's drug refill history to identify poor adherence	0.009		
Provide specific interventions to help improve adherence		0.226	0.225
Counsel on the appropriate handling and storage of insulin		0.000	0.028
Counsel on the appropriate use of insulin pens, syringes, lancets and needles (eg, sharp disposal)		0.000	0.257
Counsel on how insulin works and the key differences amongst insulin formulations	0.000		
Counsel on appropriate insulin administration (mixing insulin, injection technique, injection time)	0.005		
Describe the appropriate time to administer each oral anti-diabetic drug		0.396	0.799
Counsel about the side effects of oral anti-diabetic drugs		0.138	0.233
Counsel on current recommendations for antiplatelet therapy (eg, low dose Aspirin)	0.040		
Provide education on the importance of controlling blood pressure in diabetes		0.991	0.697
Discuss the importance of self-testing of blood glucose levels		0.601	0.433
Counsel on the current treatment targets for cholesterol in diabetes		0.265	0.280
Provide education on the importance of regular screening for retinopathy		0.154	0.503
Provide education on the importance of regular screening for nephropathy		0.138	0.565
Provide education on the importance of regular screening for neuropathic pain		0.147	0.610
Counsel on good foot care techniques		0.116	0.539
Provide education about the importance of immunization for influenza and pneumococcal pneumonia		0.270	0.643
Stress the importance of weight control in diabetes management where applicable		0.574	0.291
Stress the importance of diet and regular exercise in diabetes management		0.476	0.516
Providing chronic management service is not the main KPI of pharmacists		0.473	0.437
I do not have enough time		0.003	0.194
Shortage of personnel		0.088	0.316
I do not have a private counselling area	0.009		
Low patient expectations regarding pharmacists role in diabetes care	0.042		
Lack of diabetes related educational materials in the pharmacy	0.002		
Lack of access to patients medical profiles	0.022		
Lack of diabetes therapeutic knowledge and skills		0.095	0.844
Limited funding		0.006	0.618
Cultural or religious barriers		0.817	0.030
Lack of diabetic patients visiting the pharmacy		0.156	0.074
I am not interested in providing diabetes care		0.092	0.087
Language barrier		0.077	0.644
Lack of diabetes training programs for pharmacists	0.000		
Low patient knowledge about diabetes management		0.241	0.194

Pharmacists in different geographical areas behave differently in the education of using insulin and blood glucose meters.

Pharmacists with longer service time and more experiences spend more time on education on lifestyle and screening of blood pressure and cholesterol. Consistent with results of ANOVA, weight control, and foot care was highlighted more by pharmacists who have practiced for decades.

As the proportion of diabetes mellitus patients increases, pharmacists are more likely to focus on screening for complications and enhancing immunity.

The explanation of administrative matters and the screening of complications increase with the accumulation of practice time. The longer pharmacists work, the more comprehensive and patient-oriented the counseling was. Especially, the clear explanations on the appropriate time to administer each oral anti-diabetic drug and

possible side effects had good relativity with practice time.

Discrepancy of Barriers in Diabetes Mellitus Care

Pharmacists spreading across different regions hold distinctive levels of lack of relevant training materials in the pharmacy and programs. In some areas, pharmacists believe that limited funding may become a major factor hindering the development of pharmaceutical services. Everyone is of the opinion that providing diabetes mellitus management services is not the main performance indicator. Besides, the shortage of personnel and professional skills are common shortcomings impeding better diabetes mellitus care.

Discrepancy of Attitudes

In terms of the total score of the Likert Scale, ANOVA results show that there are differences between shorter weekly work time groups and full-time groups. The longer the pharmacists work per week, the more the pharmacists agree with the opinion that diabetes management is an extension of community pharmacy services. In specialist clinics, pharmacists take more intervention in identifying and screening complications. Besides, they believe that professional diabetes mellitus management will increase patients' understanding of the value and image of pharmacists. As a result, implementing diabetes management will bring great economic benefits.

Discussion
Summary

This study proves that Chinese pharmacists mainly provide basic services for the people with diabetes patients and their involvement in advanced services is limited. They have an average knowledge level and are in aspiration for further training. Primary care services such as intervention in lifestyle and medication monitoring are well conducted in the community, which are consistent with previous survey.[19,20,26,27] Their top perceived barriers include patients' lack of knowledge of self-management, shortage of funds, and the dearth of professional staff. Luckily, pharmacists express general positive attitudes. They are clear about primary responsibility. With the increasing popularity of diabetes care, the professional image of pharmacists and profit would improve. These results are in line with those of studies from Qatar, Canada, and the United States.[16,20,28,29] The majority of pharmacists admit that more attention should be paid to the seriousness of complications, to the community

pharmacists' responsibility, and to the importance of screening pre-diabetes.

Implications for Research and Practice

In general, community pharmacists working on diabetes mellitus care have a good background of education and can provide patient-centered services, though the team construction still has some room for improvement in several aspects. Similar to the results of this study, the results of the Qatar study show that more than half of the interviewed pharmacists have more than 5 years of work experience.[20] The above results indicate that community pharmacists have a relatively high educational background and practical experience, and have a good foundation for completing diabetes community care.

Economic and Policy Support Needs to Improve

Most pharmacists come from an economically developed region. The current health care delivery model in community settings is not comprehensive and imbalanced.[30] Benefiting from the better financial conditions and more advanced policies, pharmacists from central and east get used to monitoring glucose and take action to prevent hypoglycemia. Secondly, lacking funds is one of the biggest barriers. As a result, the shortage of funds brings deficiency of training materials and programs. To solve these problems, it is time for the government to implement positive policy to enlarge the investment in community pharmacy. Also, experienced pharmacists could guide underdeveloped areas or independent pharmacies. Or personnel in need are allowed to attend advanced studies. Benign communication and knowledge sharing contribute to a good loop to accelerate the growth on the whole.

Devices Need to Be Strengthened

The implement of diabetes mellitus care is inseparable from the rational allocation of resources. Thus providing more effective device support guarantees a better practice experience, leading to a sense of satisfaction. Similar research results show that lack of the work environmental context was one of the biggest barriers to routine monitoring and follow-up for people with diabetes.[21] Only to improve this type of problem, more and more patients are willing to accept services from a community pharmacy. There is no doubt the value of pharmacists would obtain more recognition. And confidence and expectation lead to better services, forming a sustainable loop.

Qualification of Professional Talents Need to Raise

In Canada, licensed Canadian pharmacists can become certified diabetes educators (CDE) after passing exams. Pharmacists may choose to either write a CDE exam or to accumulate 250 credits to maintain this title. Learning records can also be used to satisfy continuing education requirements to renew licenses.[31]

Obviously, in China, some community pharmacists have not passed standardized training. The low entry threshold leads to the insufficient scale of pharmacy talents. There is still room for improvement in the scale and professional level of pharmacists. A systematic review of pharmacies in South Asia showed that training is needed in the process of identifying pharmaceutical care problems because pharmacists are lacking experience in identifying and tackling care issues.[15] Therefore, relevant government departments should combine the current situation to refine licensed pharmacists and regulations, and coordinate resources to provide a suitable environment. Given respondents' major, more and more students majoring in pharmacy and traditional medicine contribute to a specialized service team from a forward-looking perspective. Relevant training departments must fully consider each major ensuring to provide a strong guarantee for qualified talents and expand the training scale of pharmacy talents aiming at working in the community, especially specialized talents.

Pharmacy Service Charges System Need to Build

Compared to dispensing medications, offering clinical customer services takes more time but produces fewer profits. In terms of services for the person with diabetes, Canadian pharmacists provide a Comprehensive Annual Care Plan and Standard Medication Management Assessment for 100 and 60 Canadian dollars respectively per patient annually. It is a great example of clinical services. By embodying the value of pharmacy services, it encourages personnel to enhance professional recognition, while improving the service quality.

Specialized in Diabetes Mellitus' Care Needs to Be Stressed

It is satisfied that 75.7% of pharmacists get used to documentation. However, it needs to be emphasized that education pertinent to immunization was rarely provided, though clinical practice guidelines recommend doing so. Studies in Australia and Canada have shown that pharmacists who underwent diabetes training provided more services relevant to diabetes management.[26,32] So Pharmacists need to participate in continuing education courses and offer more advanced and comprehensive services. For example, community pharmacists in different provinces across Canada can provide medication review, assessment, and care plan services.[31] Meanwhile, the results of the RCT study demonstrated that the medication review had a positive impact as well. There was better treatment compliance in the intervention group.[14] Specializing in certain majors may display a higher level of understanding of comprehensive and advanced diabetes care. First, pharmacy students mostly learn about drug-related knowledge but not patient-centered clinical expertise. Consequently, though passing the licensing examination, they may not have comprehensive and systematic assessment approaches. The shift of the specific pharmacy education system from a drug-oriented to a pharmaceutical-care-oriented approach is required.[33,34] Governors should pay attention to specialty training, at the same time feel the urgent requirement indeed.

Strengths and Limitations

This study is an experimental study. Due to the large number and complexity of the research object overall, it is difficult to achieve complete random. Secondly, the majority of pharmacists were the ones who worked in the eastern part, which may lead to a bias. Thirdly, only 700 pharmacists responded to the study. Results may not represent the whole portrait nationwide. To justify the result, an optimized questionnaire could be redesigned to involve more pharmacists.

Conclusion

This study proves that Chinese pharmacists mainly provide basic services for diabetic patients and their involvement in offering advanced diabetes services is limited. They have an average diabetes related knowledge level and are in aspiration for further diabetes related training and/or continuous educational activities. Their top perceived barriers for provision of diabetes care include patients' lack of knowledge of self-management shortage of fund and dearth of professional staff. Yet, pharmacists have overall positive attitudes toward taking part in diabetes management.

Ethics Approval and Informed Consent

All procedures were approved by the ethics committee of China Pharmaceutical University, in strict accordance with the guidelines set by the Bureau of Sciences and Techniques of Jiangsu Province, China. Participants in the survey all signed informed consent.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare no conflicts of interest.

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