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Research article

Investigation on pharmaceutical care barriers perceived by clinical pharmacists in secondary and tertiary hospitals in China

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ABSTRACT

Objective: This study aimed to understand the current status of pharmaceutical care barriers perceived by clinical pharmacists in secondary and tertiary hospitals in China, and to provide a reference for further improving the quality of pharmaceutical care and perfecting the construction of pharmaceutical care system in China.

Methods: The PCBS-CH scale (Pharmaceutical Care Barriers Scale in Chinese Hospitals) was used to measure the perceived pharmaceutical care barriers of clinical pharmacists, and descriptive statistical analysis was used to identify the main barriers faced by clinical pharmacists. The different barriers perceived by clinical pharmacists with various characteristics was investigated by subgroup analysis.

Results: A total of 1266 clinical pharmacists from 31 provinces were finally included. The results revealed that the main barriers faced by clinical pharmacists in the process of implementing pharmaceutical care included lack of additional staffing, lack of time for pharmaceutical care provision and continuing education, and lack of an electronic information system and prescription evaluation system for pharmaceutical care. Subgroup analysis found that clinical pharmacists who are without training ($P < 0.001$), worked in tertiary hospitals ($P = 0.036$), and had other training certificates ($P < 0.001$) perceived higher pharmaceutical care barriers.

Conclusion: Clinical pharmacists in secondary and tertiary hospitals in China have a low perception of overall pharmaceutical care barriers, but still face some important barriers. In order to promote the development of pharmaceutical care in China, the quality of clinical pharmacists should be improved, strict entry criteria should be established, clear responsibilities should be defined, the rights of female clinical pharmacists should be protected, and hospital facilities should be upgraded.

1. Introduction

The concept of pharmaceutical care was first introduced in 1990 by Hepler CD and Strand LM [1]. The Opinions on Accelerating the High-quality Development of Pharmaceutical Care [2] clearly points out that pharmaceutical care is an important part of medical institutions' diagnosis and treatment activities and an important link to promote rational drug use, improve medical quality and ensure the safety of patients' medication. Drug-related problems are considered to be a major public health concern and a leading cause of

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morbidity and mortality in the world [3,4]. Many studies have demonstrated that the provision of pharmaceutical care by clinical pharmacists can address drug-related problems, improving patient healthcare outcomes and decreasing medical costs [5–7]. Nowadays, pharmaceutical care have been adopted by pharmaceutical professionals in many countries and developed in various forms [8].

In China, pharmaceutical care was first implemented in the late 1990s. However, the current status of pharmaceutical care is not ideal after more than 20 years of development. It has been reported that the software, hardware, and personnel related to pharmaceutical care in county hospitals are generally inadequate, and the educational background and work experience of clinical pharmacists are not qualified enough [9]. There are also deficiencies in tertiary hospitals with abundant medical resources, such as lack of payment rules and performance evaluation system for pharmaceutical care, and a simple form of pharmaceutical care activities [10]. These deficiencies have seriously hindered the development of hospital pharmacy in China and caused barriers for clinical pharmacists to implement patient-centered pharmaceutical practice. Pharmaceutical care barriers refer to all kinds of unfavorable conditions that hinder the smooth development of pharmaceutical care [11]. Studies have shown that pharmaceutical care barriers may increase role conflict and role ambiguity of clinical pharmacists [12,13], preventing them from fulfilling their roles.

Pharmacists in various countries still face pharmaceutical care barriers to different degrees despite of the great progress made about the pharmaceutical care around the world [14]. In the United States [15], where pharmaceutical care was first proposed and developed rapidly, the most common barriers for pharmacists are related to compensation and inadequate staffing. In countries where the development of clinical pharmacy is relatively backward and clinical pharmacists are mainly responsible for drug supply, there are barriers such as lack of practice experience of clinical knowledge [16] and inability to find their roles [17]. Pharmaceutical care barriers are also among hospital and community pharmacists apart from clinical pharmacists. Among Gulf Cooperation Council countries, the main barriers for pharmacists are inconvenient access to patient medical records, insufficient staff [18], and incompliant patients [19]. In Jordan, pharmacist's low self-confidence is a major personal barrier encountered in community pharmacy settings [20].

At present, there are great differences in the level of pharmaceutical care of hospitals in different regions of China [21], and pharmaceutical care are rarely implemented in primary hospitals. Pharmaceutical care barriers faced by clinical pharmacists are varied and complex. Different approaches have been used by Chinese scholars to explore the barriers to the development of pharmaceutical care [12,22–24]. However, existing studies are small in sample and have been conducted only in sectional areas, resulting in findings that were not sufficiently representative and generalizable. In addition, the analytical methods were not well developed and suitable measurement tools were still lacking in existing studies, which may lead to a large bias in the results. Failure to accurately identify pharmaceutical care barriers will prevent clinical pharmacists from providing appropriate pharmaceutical care, affecting the quality of healthcare services and patients' satisfaction. Therefore, correctly identifying pharmaceutical care barriers and proposing targeted solutions can help improve the level of pharmaceutical care in China and promote the construction of a high-quality and efficient healthcare service system.

In China, clinical pharmacy started late, and the inclusion of clinical pharmacy as a major in most universities began after 2012 [25]. There are two main ways to become a clinical pharmacist. For clinical pharmacy professionals, they can become general clinical pharmacists through hospital recruitment and apply for training to become a specialized clinical pharmacist after working for a certain number of years. For pharmacy professionals, they can work as hospital pharmacists for a sufficiently long time before applying for training and transform into clinical pharmacists [26]. Either way, a qualification certificate must be obtained in order to be qualified to practice as a clinical pharmacist. Different certificates can be obtained by passing examinations organized by different departments. There is no definite requirement for educational qualifications in clinical pharmacist, and higher degree will only increase the chances of a successful application. However, clinical pharmacist possessing of a master degree is more inclined to the theoretical training of clinical pharmacy compared to a clinical pharmacist with doctoral degree focusing more on scientific research [27]. Clinical pharmacists in China are divided into three levels: junior, intermediate and senior, which correspond to different technical titles. The higher the level of technical titles, the higher the professional ability and the higher the evaluation requirements. Therefore, information related to the education, technical title, training, and qualification acquisition reflects the personal skills and professional abilities of clinical pharmacists, which may affect the smooth operation of pharmaceutical care [28–31].

This study conducts a sample survey of secondary and tertiary hospitals in China to clarify the main pharmaceutical care barriers and the characteristics of clinical pharmacists facing barriers. And targeted solution strategies and approaches are proposed with a view to providing reference for improving the quality of pharmaceutical care of clinical pharmacists and perfecting the construction of pharmaceutical care system in China.

2. Material and methods

2.1. Sample

Based on informed consent and voluntary participation, a cross-sectional study was conducted from July to August 2019 to investigate the status of pharmaceutical care barriers among clinical pharmacists in secondary and tertiary hospitals in China. A multistage sampling method was used in order to provide a broader coverage of the sample and to reflect the overall working conditions of clinical pharmacists in China. The steps are as follows: (1) All cities/urban areas in 31 provinces (autonomous regions and municipalities directly under the Central Government) in mainland China were divided into three urban groups (high, medium and low) according to the per capita GDP in 2018, and a total of 93 urban groups were acquired. (2) Hospitals were selected by convenience sampling from the hospitals that agree to carry out the investigation. At least 2 secondary hospitals and 2 tertiary hospitals were selected from each urban group. (3) At least 2 clinical pharmacists filled up questionnaires in each sample hospital in accordance with

the principle of convenience sampling. The sampling and data collection process of this study was shown in Fig. 1.

The inclusion criteria for the sampled clinical pharmacists were as follows: (1) full-time clinical pharmacists in the sample hospitals; (2) undertaking specific responsibilities for medicines, patient or health information management; (3) available and willing to complete the questionnaire, which took approximately 20–30 min; and (4) able to write the informed consent document. Clinical pharmacists in training (students on clerkships or internships) and visiting clinical pharmacists were excluded.

According to Raosoft calculator [32], the minimum sample size is 663 participants. The total estimated size is 468000 [33] with a 99 % confidence level, ±5 % margin of error, and 50 % response distribution.

2.2. Instrument

The questionnaire, which contains two sections, was designed by the research team in the Chinese language. The first section collected the sociodemographic characteristics and work experience data of the participants. The second section measured pharmaceutical care barriers. This study adopted the PCBS-CH scale (Pharmaceutical Care Barriers Scale in Chinese Hospitals), a scale that was developed in reference to the existing scales but was adapted to the specific context of China [34]. The PCBS-CH scale contains 21 items measuring five domains of pharmaceutical care barriers, namely cognition and attitude (three items), knowledge and skills (four items), objective conditions (seven items), external cooperation (three items), and support from managers (four items). Each item was rated on a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = uncertain, 4 = agree, 5 = strongly agree), with a higher score indicating more severe pharmaceutical care barriers. A summed score was calculated for the entire PCBS-CH scale and its five domains respectively. A pre-test of 181 clinical pharmacists from 92 hospitals in Jiangsu Province was conducted using the multi-stage sampling and convenience sampling methods mentioned above. The Cronbach's alpha coefficients for the PCBS-CH scale and the five dimensions of cognition and attitude, knowledge and skills, objection conditions, external cooperation, and support from managers were 0.908, 0.674, 0.850, 0.863, 0.897, and 0.809, respectively, indicating acceptable internal consistency for the scale and its five domains (Table 1). The Kaiser-Meyer-Olkin (KMO) value of the PCBS-CH scale and the five dimensions were 0.847, 0.659, 0.786, 0.840, 0.728, 0.659, respectively, showing that the questionnaire has high construct validity. Therefore, no any adjustments were made to the PCBS-CH scale. The pre-test sample was included in the final data analysis.

2.3. Data collection

In this study, undergraduate students with pharmacy background were recruited as investigators to interview clinical pharmacists in the sample hospitals. Before the formal investigation, the investigators were trained by the research team on the research background, purpose, content, methodology, etiquette and handling of emergencies, as well as the use of the research software purchased and redeveloped by the research team. After obtaining permission from hospital administrators, the investigators entered the hospital and asked for basic information about potential participants to determine whether they met the study inclusion criteria. Then the purpose, content and requirements of the survey were explained to eligible participants and their willingness to participate were asked. The questionnaire was started after consent was obtained and the informed consent document was written by the participants.

Choosing a quiet environment that was not disturbed by other people, the investigators conducted verbal interviews with the participants using questionnaires in an online survey system on a mobile phone or tablet. The investigators read aloud each question and answer in the questionnaire, recorded the respondents' answers with the survey system and converted the data into electronic documents in time. To ensure the authenticity of the questionnaire data, the participants were asked to complete the questionnaire independently and the investigators were not allowed to provide any comments on the questionnaire except for the requirements or instructions of questionnaire filling. A total of 5 trained postgraduates were recruited as data reviewers to review the data uploaded to the system. If obvious errors were found in the data, they would be returned to the investigators who would verify and correct the data with the participants to ensure validity. To protect the security of participants' information, the data is encrypted and access is restricted apart from authorized people.

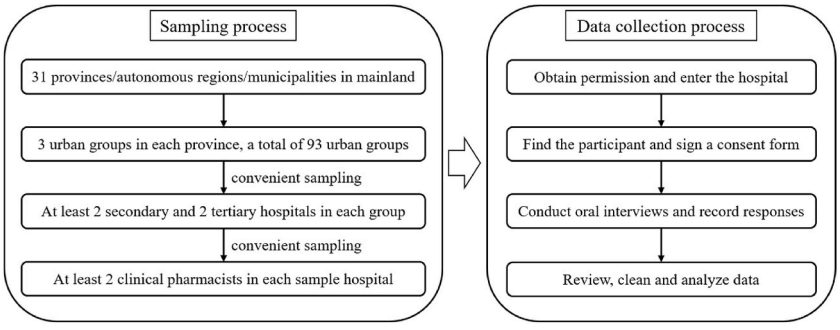

Fig. 1. The sampling and data collection process.

Table 1
Reliability and validity test.

Item	All dimensions	Cognition and attitude	Knowledge and skills	Objective conditions	External cooperation	Support from managers
Alpha reliability coefficient						
Cronbach's a based on standardised items	0.908	0.674	0.850	0.863	0.897	0.809
Bartlett test of sphericity						
Kaiser–Meyer– Olkin measure of sampling adequacy	0.847	0.659	0.786	0.840	0.728	0.659
Approximate Chi-squared	2096.248	86.092	329.105	543.404	346.621	296.321
d.f.	210	3	6	21	3	6
P-value	0.000	0.000	0.000	0.000	0.000	0.000

2.4. Data analysis

The online electronic data were imported into SPSS 26.0, and the researchers verified the data and tested the reliability and validity of the scale. All surveyed clinical pharmacist data were cleaned and filtered based on logical relationships using Excel 2019. For example, the cases that the difference between participants' working years and their age is less than 16 years were excluded. Descriptive statistical analysis was then performed. The 5-point Likert scale was downscaled in a way that respondents who selected "agree" and "strongly agree" were considered to agree that there were corresponding barriers. The percentage of agreement for each barrier was calculated to identify the main barriers faced. Means and SDs of pharmaceutical care barriers (including its five domains) scores were calculated. Subsequently, subgroup analyses were conducted to compare the level of barriers perceived by clinical pharmacists based on sociodemographic characteristics and work experience data. The ANOVA test and multiple comparisons were used to explore whether the barriers perceived by clinical pharmacists with different characteristics were consistent.

3. Results

3.1. Sociodemographic

A total of 1300 questionnaires were collected, of which 1266 were valid, with a valid rate of 97.38 %. Of the excluded 34 questionnaires that could not be corrected or refilled by return visits, 2 were complete duplicates, 7 had errors in completion, and 25 had logical errors. The study covered 652 hospitals in 31 provinces in China, including 307 secondary hospitals and 345 tertiary hospitals, most of which were general hospitals (76.38 %) (Table 2).

The basic characteristics of the interviewed clinical pharmacists were shown in Table 3. The participants were relatively young with the mean age of 35.68 years (SD = 7.01). Their mean years of practice as a clinical pharmacist was 9.80 years (SD = 6.96), and a majority of the participants hold junior title (34.68 %) and intermediate titles (51.97 %), which is inexperienced in practice. Most of the participants were women (65.01 %) and the majority were married (83.25 %). Unlike many parts of the world where clinical pharmacy requires specialization or a doctoral degree, most of the participants' highest education was bachelor's degree (63.11 %) and master's degree (28.44 %), and only 0.87 % had doctoral degree. This is because most of the clinical pharmacists were transformed from hospital pharmacists who did not have an educational background in clinical pharmacy and their degree were low. In addition, the majority of them specialized in internal medicine and had received national or provincial training. Most clinical pharmacists are qualified to engage in clinical pharmacy by obtaining a certificate of clinical pharmacist training of Ministry of Health (46.05 %) and a certificate of clinical pharmacist refresher training (33.33 %).

Table 2
Sample hospitals (N = 652).

Item	n (%)
Hospital grade	
Secondary	307 (47.09)
Tertiary	345 (52.91)
Hospital type	
Chinese medicine hospital	77 (11.81)
Specialized hospital	36 (5.52)
General hospital	498 (76.38)
Integrated Chinese and western medicine hospital	19 (2.91)
Nursing home	14 (2.15)
Maternal and child health hospital	3 (0.46)
Other	5 (0.77)

Table 3
Sociodemographic characteristics of clinical pharmacists (N = 1266).

Item	n (%)
Age , mean (SD)	35.68 (7.10)
Years of practice , mean (SD)	9.80 (6.96)
Gender	
Male	443 (34.99)
Female	823 (65.01)
Marital status	
Unmarried	204 (16.11)
Married	1054 (83.25)
Other (divorced or widowed)	8 (0.63)
Technical title	
Junior title	439 (34.68)
Intermediate title	658 (51.97)
Vice-senior title	146 (11.53)
Senior title	23 (1.82)
Education	
Below bachelor's degree	96 (7.58)
Bachelor's degree	799 (63.11)
Master's degree	360 (28.44)
Doctoral degree	11 (0.87)
Training	
National specialized training	374 (29.54)
National general training	235 (18.56)
Provincial specialized training	290 (22.91)
Provincial general training	250 (19.75)
Without training	286 (22.59)
Specialty	
Anti-infection specialty	323 (25.51)
Internal medicine specialty	639 (50.47)
Antineoplastic drug specialty	98 (7.74)
Organ transplant specialty	16 (1.26)
ICU specialty	66 (5.21)
Other	292 (23.06)
Qualification acquisition	
Certificate of clinical pharmacist training of Ministry of Health	583 (46.05)
Certificate of clinical pharmacist refresher training	422 (33.33)
Certificate of clinical pharmacist training faculty of the National Health and Family Planning Commission	272 (21.48)
Participate in relevant clinical pharmacist training abroad	32 (2.53)
Other training certificates	226 (17.85)

3.2. Pharmaceutical care barriers perceived by clinical pharmacists

On average, the respondents reported a pharmaceutical care barrier score of 50.96 (SD = 13.31) with a total score of 105. The scores for each domain, which can be seen in Table 4, are as follows: 5.42 ± 1.97 for cognition and attitude; 9.77 ± 3.33 for knowledge and skills; 18.43 ± 5.82 for objective conditions; 7.44 ± 2.71 for external cooperation; 9.90 ± 3.28 for support from managers. These scores showed that clinical pharmacists' overall perception of pharmaceutical care barrier is at a medium level, with fewer barriers in the cognition and concept, and more barriers in the objective conditions and support from managers.

The average percentage of agreement for pharmaceutical care barriers was 22.50 %. The vast majority of clinical pharmacists felt few barriers in the domain of cognitive and attitude with an average agreement rate of 6.37 %. Only 2.61 % of clinical pharmacists had inappropriate attitude toward pharmaceutical care, which showed that the respondents endorse the importance of pharmaceutical care. In terms of knowledge and skills, the barrier with the highest proportion of agreement was lack of clinical medical knowledge (27.49 %), which may affect the clinical treatment effect of patients. There were many barriers in the domain of objective conditions, including lack of additional staffing (44.87 %), lack of time for pharmaceutical care provision (38.15 %) and lack of an electronic information system and prescription evaluation system (31.75 %). These barriers lead to the inability of clinical pharmacists to provide effective pharmaceutical care. For the domain of support from managers, more than one-third of the respondents thought that lack of time for continuing education was a barrier, which contributed to their incapacity to learn more clinical and pharmaceutical knowledge.

3.3. The barriers perceived by clinical pharmacists with different characteristics

The results of the subgroup analysis showed that respondents who were without training ($P < 0.001$), worked in tertiary hospitals ($P = 0.036$), and had other training certificates ($P < 0.001$) reported more severe pharmaceutical care barriers (Table 5). For the domain of cognition and attitude, respondents with different hospital grades ($P = 0.002$), hospital types ($P = 0.036$) and training situation ($P < 0.001$) had significant differences in the level of perceived barriers. For the domain of knowledge and skills, there was a

Table 4
Pharmaceutical care barriers perceived by clinical pharmacists.

Item	Mean (SD)	Agree (%)
Overall pharmaceutical care barriers	50.96 (13.31)	22.50
Cognition and attitude	5.42 (1.97)	6.37
Lack of understanding of the components of pharmaceutical care	1.88 (0.88)	7.66
Inappropriate attitude of pharmacists toward pharmaceutical care	1.55 (0.70)	2.61
Lack of confidence for pharmaceutical care development	1.98 (0.96)	8.85
Knowledge and skills	9.77 (3.33)	20.93
Lack of communication skills	2.29 (0.93)	14.77
Lack of knowledge in clinical pharmacy	2.32 (0.98)	16.90
Lack of knowledge in clinical medicine	2.59 (1.08)	27.49
Lack of electronic information technology and document retrieval skills	2.57 (1.06)	24.57
Objective conditions	18.43 (5.82)	30.60
Lack of an electronic management system of pharmaceutical care	2.56 (1.10)	24.96
Lack of additional staffing (pharmacist, technician, or support staff)	3.01 (1.19)	44.87
Lack of rules and regulations of pharmaceutical care practice	2.22 (0.97)	15.40
Lack of physical space for pharmaceutical care provision	2.59 (1.13)	31.04
Lack of time for pharmaceutical care provision	2.78 (1.13)	38.15
Lack of an electronic information system and prescription evaluation system	2.64 (1.16)	31.75
Lack of an efficient and standardized documentation system	2.62 (1.08)	28.04
External cooperation	7.44 (2.71)	21.83
Lack of communication with doctors and their support	2.46 (0.99)	20.22
Lack of communication with other medical service staff and their support	2.46 (0.99)	21.25
Lack of communication with patients and their support	2.53 (1.02)	24.01
Support from managers	9.90 (3.28)	22.49
Lack of opportunities for continuing education	2.50 (1.05)	23.30
Lack of time for continuing education	2.73 (1.12)	33.65
Lack of support from hospital leaders	2.45 (1.00)	20.22
Lack of support from upper management	2.23 (0.90)	12.80

significant difference in the level of perceived barriers between respondents of different gender ($P < 0.001$), years of practice ($P = 0.036$), training situation ($P < 0.001$), specialty ($P = 0.039$) and qualification acquisition ($P < 0.001$). For the domain of objective conditions, respondents of different hospital grades ($P = 0.004$), training situation ($P < 0.001$), specialty ($P = 0.012$) and qualification acquisition ($P = 0.002$) differed significantly. For the domain of external cooperation, the perceived barriers of the respondents with different years of practice ($P = 0.016$), training situation ($P < 0.001$) and qualification acquisition ($P = 0.003$) were significantly different. For the domain of support from managers, there was a significant difference among respondents with different genders ($P = 0.011$), hospital grades ($P = 0.001$), highest education ($P = 0.021$), and training situation ($P < 0.001$). The perception degree of each subgroup on each barrier was shown in Appendix 1, and the results of multiple comparisons were shown in Appendix 2.

4. Discussion

The purpose of this study was to identify the pharmaceutical care barriers perceived by clinical pharmacists. The sample covered all provinces in mainland China with an adequate sample size. The distribution of gender, age, educational background, and technical title of this sample was similar to the sample indicators reported in previous national clinical pharmacist survey [35,36], indicating that the representativeness of the sample was acceptable. As expected, clinical pharmacists face many barriers in implementing pharmaceutical care. The most significant of which included inadequate staffing of pharmaceutical workers, lack of time for pharmaceutical care provision, lack of time for continuing education, and lack of an electronic information system and prescription evaluation system. Barriers mainly came from objective conditions. Clinical pharmacists with different characteristics encountered different barriers. Subgroup analysis found that clinical pharmacists who were without training, worked in tertiary hospitals, and had other training certificates perceived more severe pharmaceutical care barriers. In addition to age, marital status, and technical title, the perceived level of some of the domains varied by gender, years of practice, hospital type, highest education, and specialty.

4.1. Pharmaceutical care barriers perceived by clinical pharmacists

The low level of perceived barriers to pharmaceutical care among Chinese clinical pharmacists is inconsistent with the high percentage of agreement in countries such as the United States [15], Kuwait [37], and Sudan [16]. Since this is the first time that the PCBS-CH scale has been used in China on a large sample of actual situations, this result is acceptable. Unlike other scales used in other countries, the scale was debugged during development to fit the Chinese context, measuring different domains and items [34]. Therefore, measurement results are not comparable with those of other countries. Clinical pharmacy in China has made gratifying progress compared to twenty years ago. The environment, facilities and personnel required for the implementation of pharmaceutical care have been improved, and the government has issued relevant guidance and opinions to gradually attach importance to pharmaceutical care [2]. However, the pride generated from these advances may make clinical pharmacists overlook the barriers they face. In addition, influenced by the traditional Confucian culture, Chinese are reserved and reluctant to express themselves, especially when

Table 5
Results of subgroup analysis.

Characteristics	Pharmaceutical care barriers		Cognition and attitude		Knowledge and skills		Objective conditions		External cooperation		Support from managers	
	Mean (SD)	Agree (%)	Mean (SD)	Agree (%)	Mean (SD)	Agree (%)	Mean (SD)	Agree (%)	Mean (SD)	Agree (%)	Mean (SD)	Agree (%)
Gender	P = 0.830		P = 0.456		P < 0.001		P = 0.471		P = 0.919		P = 0.011	
Male	51.07 (12.96)	21.96	5.47 (2.07)	6.85	9.33 (3.05)	15.97	18.59 (5.88)	30.64	7.45 (2.57)	20.62	10.22 (3.35)	25.11
Female	50.9 (13.5)	22.79	5.39 (1.92)	6.12	10 (3.45)	23.60	18.35 (5.79)	30.58	7.44 (2.78)	22.48	9.73 (3.23)	21.08
Age	P = 0.804		P = 0.352		P = 0.412		P = 0.900		P = 0.065		P = 0.096	
20–29 years	51.58 (13.73)	23.14	5.55 (2.1)	6.61	9.94 (3.36)	22.07	18.37 (5.76)	30.05	7.87 (2.74)	27.48	9.84 (3.42)	21.28
30–39 years	50.75 (13.27)	22.52	5.33 (1.99)	6.37	9.83 (3.4)	21.71	18.46 (5.85)	30.82	7.37 (2.76)	21.67	9.75 (3.29)	21.57
40–49 years	51.21 (12.99)	22.45	5.47 (1.8)	5.96	9.51 (3.2)	18.98	18.53 (5.75)	30.87	7.36 (2.55)	19.22	10.34 (3.17)	26.00
50 years and above	50.16 (13.75)	20.24	5.63 (2.07)	7.29	9.52 (3.08)	16.80	17.94 (6.15)	29.02	7.14 (2.65)	15.10	9.94 (2.98)	21.88
Marital status	P = 0.772		P = 0.328		P = 0.876		P = 0.908		P = 0.259		P = 0.583	
Unmarried	51.57 (13.22)	22.22	5.6 (2.05)	6.54	9.87 (3.31)	20.59	18.32 (5.56)	28.15	7.73 (2.88)	26.14	10.05 (3.27)	22.30
Married	50.85 (13.32)	22.54	5.38 (1.96)	6.33	9.75 (3.33)	20.94	18.45 (5.87)	31.02	7.39 (2.68)	21.00	9.88 (3.29)	22.60
Other (divorced or widowed)	50.5 (15.8)	24.40	5.25 (1.58)	8.33	9.5 (4.38)	28.13	19.13 (7.28)	37.50	7.63 (2.39)	20.83	9 (1.85)	12.50
Years of practice	P = 0.373		P = 0.909		P = 0.036		P = 0.889		P = 0.016		P = 0.412	
Under 10 years	51.26 (13.31)	22.91	5.43 (2.02)	6.46	9.94 (3.29)	21.47	18.48 (5.75)	30.91	7.61 (2.78)	24.24	9.81 (3.32)	21.68
10–19 years	50.96 (12.84)	22.18	5.42 (1.92)	6.58	9.68 (3.5)	21.45	18.44 (5.79)	29.55	7.33 (2.59)	19.56	10.09 (3.2)	23.68
20 years and above	49.65 (14.31)	21.46	5.35 (1.89)	5.49	9.21 (3.08)	17.38	18.23 (6.25)	31.71	6.98 (2.62)	16.46	9.87 (3.25)	23.32
Hospital grade	P = 0.036		P = 0.002		P = 0.172		P = 0.004		P = 0.051		P = 0.001	
Secondary	49.77 (13.51)	21.18	5.3 (1.99)	5.92	9.64 (3.3)	20.28	17.95 (5.98)	28.87	7.29 (2.72)	21.12	9.6 (3.3)	20.11
Tertiary	52.09 (13.02)	23.74	5.53 (1.95)	6.80	9.89 (3.36)	21.55	18.89 (5.64)	32.23	7.59 (2.7)	22.49	10.19 (3.23)	24.73
Hospital type	P = 0.443		P = 0.036		P = 0.662		P = 0.589		P = 0.438		P = 0.267	
Chinese medicine hospital	51.57 (14.53)	22.57	5.64 (2.12)	6.71	9.75 (3.44)	21.75	18.4 (6.24)	29.31	7.54 (2.65)	21.43	10.25 (3.52)	24.35
Specialized hospital	48.26 (12.76)	18.39	5.42 (1.96)	6.02	9.06 (3.07)	12.85	17.75 (5.77)	29.17	7.04 (2.64)	19.44	9 (2.72)	13.54
General hospital	50.89 (13.08)	22.48	5.33 (1.9)	5.91	9.82 (3.32)	21.22	18.39 (5.76)	30.51	7.44 (2.7)	21.48	9.91 (3.29)	22.89
Integrated Chinese and western medicine hospital	52.79 (14.08)	24.44	6.32 (2.33)	11.40	9.89 (3.53)	24.34	19.21 (5.38)	32.33	7.32 (2.7)	24.56	10.05 (3.15)	20.39
Nursing home	52.75 (13.91)	28.40	5.46 (2.86)	14.29	9.57 (3.41)	22.32	19.82 (6.24)	38.27	7.96 (3.55)	33.33	9.93 (2.87)	24.11
Maternal and child health hospital	56.83 (12.09)	30.95	5.5 (1.52)	5.56	10.67 (3.14)	16.67	20.83 (5.64)	45.24	9.33 (2.94)	50.00	10.5 (2.95)	25.00
Other	52.56 (15.63)	23.81	6.33 (1.66)	7.41	10 (4)	25.00	19.56 (6.67)	33.33	7.22 (2.59)	18.52	9.44 (3.17)	22.22
Technical title	P = 0.988		P = 0.394		P = 0.670		P = 0.546		P = 0.051		P = 0.980	
Junior title	51.11 (13.18)	21.78	5.54 (1.98)	6.83	9.79 (3.3)	20.79	18.2 (5.64)	27.99	7.72 (2.78)	24.53	9.86 (3.2)	21.07
Intermediate title	50.93 (13.57)	22.97	5.35 (2.03)	6.43	9.78 (3.41)	21.24	18.54 (5.9)	31.78	7.34 (2.69)	21.18	9.92 (3.35)	23.02
Vice-senior title	50.68 (12.71)	22.37	5.38 (1.69)	4.79	9.75 (3.13)	20.55	18.45 (5.94)	32.09	7.14 (2.58)	17.81	9.97 (3.19)	23.80
Senior title	50.87 (12.43)	23.60	5.13 (1.87)	5.80	8.91 (3.03)	17.39	19.78 (6.42)	37.27	7 (2.52)	14.49	10.04 (3.52)	26.09

(*continued on next page*)

Table 5 (*continued*)

Characteristics	Pharmaceutical care barriers		Cognition and attitude		Knowledge and skills		Objective conditions		External cooperation		Support from managers	
	Mean (SD)	Agree (%)	Mean (SD)	Agree (%)	Mean (SD)	Agree (%)	Mean (SD)	Agree (%)	Mean (SD)	Agree (%)	Mean (SD)	Agree (%)
Education	P = 0.208		P = 0.415		P = 0.492		P = 0.486		P = 0.209		P = 0.021	
Below bachelor's degree	50.08 (15.63)	22.87	5.55 (1.86)	6.60	9.94 (3.8)	25.52	17.77 (6.34)	29.32	7.44 (3.12)	24.65	9.39 (3.52)	19.79
Bachelor's degree	51.21 (13.09)	22.53	5.45 (1.94)	6.42	9.74 (3.27)	20.18	18.54 (5.85)	30.75	7.44 (2.69)	21.86	10.04 (3.23)	23.06
Master's degree	50.9 (13.14)	22.72	5.32 (2.08)	6.39	9.83 (3.35)	21.81	18.43 (5.68)	30.91	7.49 (2.64)	21.67	9.82 (3.28)	22.36
Doctoral degree	43.09 (11.73)	9.96	4.73 (1.62)	0.00	8.36 (2.87)	6.82	16.73 (3.9)	20.78	5.73 (2.24)	0.00	7.55 (3.7)	9.09
Training	P < 0.001		P < 0.001		P < 0.001		P < 0.001		P < 0.001		P < 0.001	
National specialized training	49.12 (13.29)	21.64	5 (1.79)	4.44	9.72 (3.31)	21.67	18.36 (6.18)	33.26	6.94 (2.62)	17.44	9.1 (3.3)	17.34
National general training	51.66 (13.04)	22.79	5.45 (1.97)	6.59	9.6 (3.08)	18.46	18.52 (5.71)	30.15	7.89 (2.73)	25.39	10.19 (3.35)	24.42
Provincial specialized training	50.2 (12.65)	19.02	5.67 (2.11)	7.80	9.3 (2.98)	15.82	18.05 (5.59)	25.23	7.15 (2.37)	16.31	10.02 (3.04)	21.81
Provincial general training	52.34 (12.3)	22.74	5.72 (1.88)	6.21	9.91 (3.2)	20.34	18.34 (5.3)	28.22	7.94 (2.56)	26.09	10.42 (3.4)	25.47
Without training	54.63 (13.31)	28.47	5.68 (2.05)	8.97	10.88 (3.62)	31.03	19.71 (5.59)	36.91	8.02 (2.86)	28.09	10.35 (3.17)	26.05
Two or more trainings	46.18 (13.58)	16.14	5.08 (1.94)	3.43	8.24 (2.93)	8.82	16.43 (5.94)	21.85	6.66 (2.75)	17.16	9.76 (3.23)	22.24
Specialty	P = 0.135		P = 0.396		P = 0.039		P = 0.012		P = 0.114		P = 0.541	
Anti-infection specialty	52.26 (13.1)	24.99	5.29 (1.73)	4.98	10.24 (3.42)	24.88	19.05 (5.79)	34.65	7.73 (2.7)	24.61	9.94 (3.19)	23.48
Internal medicine specialty	49.9 (13.43)	21.15	5.36 (1.98)	6.25	9.42 (3.26)	18.75	17.88 (5.82)	28.00	7.2 (2.63)	19.95	10.04 (3.29)	23.63
Antineoplastic drug specialty	52.41 (13.41)	25.89	5.23 (2)	6.25	9.95 (3.46)	23.83	19.53 (6.37)	38.84	7.84 (2.61)	22.92	9.84 (3.52)	22.27
Organ transplant specialty	40 (14)	4.76	5.33 (1.15)	0.00	9 (3.61)	8.33	11.67 (4.04)	0.00	6 (3)	0.00	8 (4)	16.67
ICU specialty	51.84 (14.12)	25.22	5.16 (2.18)	6.06	10.39 (3.98)	27.84	19.55 (6.02)	37.34	7.57 (2.91)	22.73	9.18 (2.93)	17.61
Other	51.86 (13.65)	23.53	5.59 (2.07)	7.45	9.99 (3.42)	22.53	18.78 (5.66)	31.14	7.61 (2.82)	24.05	9.89 (3.45)	22.89
Two or more specialties	50.54 (11.92)	19.76	5.63 (2.02)	7.14	9.67 (2.91)	16.79	18.17 (5.7)	27.96	7.42 (2.72)	20.00	9.64 (2.97)	17.68
Qualification acquisition	P < 0.001		P = 0.052		P < 0.001		P = 0.002		P = 0.003		P = 0.154	
Certificate of clinical pharmacist training of Ministry of Health	50.56 (12.4)	21.92	5.23 (1.86)	4.68	9.85 (3.17)	21.31	18.39 (5.64)	30.47	7.28 (2.59)	20.18	9.81 (3.21)	21.79
Certificate of clinical pharmacist refresher training	50.39 (13.74)	21.61	5.63 (2.18)	9.29	9.42 (3.38)	19.08	18.08 (5.9)	28.35	7.51 (2.76)	23.03	9.74 (3.35)	20.52
Certificate of clinical pharmacist training faculty of the National Health and Family Planning Commission	50.95 (14.18)	21.70	5.69 (2.29)	9.07	9.43 (3.41)	18.20	18.39 (6)	29.25	7.56 (2.67)	21.77	9.87 (3.4)	21.43
Participate in relevant clinical pharmacist training abroad	47.38 (18.41)	18.45	5.38 (1.92)	4.17	9.63 (3.58)	25.00	18 (8.28)	25.00	6.75 (3.28)	20.83	7.63 (2.5)	9.38
Other training certificates	54.71 (12.9)	28.55	5.47 (1.79)	6.24	11.07 (3.45)	31.51	19.85 (5.53)	38.23	8.03 (2.78)	27.85	10.28 (3.27)	25.91
Two or more qualifications	48.78 (13.44)	19.27	5.26 (1.83)	4.45	8.95 (3.04)	13.48	17.55 (5.96)	26.99	7.02 (2.73)	17.51	10.01 (3.24)	23.96

expressing their barriers and dissatisfaction at work. The phenomenon that people may downgrade their true feelings because of nervousness or fear of being blamed by the leadership for saying the wrong thing may bias the results, however, the study still found some important barriers.

Lack of additional staffing is the barrier that clinical pharmacists perceive the most. Other scholars in China have also reported the

same barrier [12,38], which is also a common barrier in Malaysian [39], Qatari [18], Portuguese [40], Jordan [41] and Australian [42]. This may be due to the fact that the responsibilities of clinical pharmacists are not obvious and are not supported by other healthcare professionals in these countries. Studies have shown that negative attitudes from other healthcare professionals may undermine the intent of clinical pharmacist candidates to provide pharmaceutical care [43], while preventing them from becoming clinical pharmacists. China's "zero mark-up policy" for drugs has prevented hospitals from reaping the benefits of drugs, which has further contributed to the lack of attention paid to clinical pharmacists [12]. Therefore, the understanding of the value of clinical pharmacists in medical quality and medical cost in hospitals needs to be strengthened. In addition, five-year undergraduate education plus three-year master's education makes it difficult for graduates to enter the workforce quickly, leading to a shortage of clinical pharmacy graduates [25]. Meanwhile, hospital pharmacists have the desire to transform into clinical pharmacists, but are limited in their ability to do so [44,45]. Therefore, the grade evaluation and performance appraisal system should be improved in the short term to enhance the quality of clinical pharmacists. In the long term, a mandatory training program should be established to enable candidates to become clinical pharmacists.

Time constraints also pose a challenge to clinical pharmacists in carrying out clinical pharmacy. It has been reported that in China, the time of clinical pharmacists is often occupied by traditional pharmacy tasks, which leads to their lack of sufficient time to carry out high-quality pharmaceutical care, including pharmaceutical clinics, pharmaceutical rounds and individualized medication [46]. However, despite the introduction of the Regulations of Pharmaceutical Administration in Medical Institutions in 2010, the boundaries between clinical pharmacists and other pharmacists have not been defined in China, which led to an unclear division of duties and tasks [47]. Busy pharmacy work is also an important reason why clinical pharmacists lack time for continuing education [48]. Therefore, reasonable work arrangement and clear division of responsibilities are essential measures. And relative law should be established to clarify the duties of clinical pharmacists from the legal level [49]. In addition, lack of confidence in pharmaceutical care and fear of additional responsibilities among some clinical pharmacists may also be the reason why they reluctant to spend time on pharmaceutical care [50]. More practice of clinical pharmaceutical care is needed to gain experience and confidence.

The lack of software required for pharmaceutical care, such as electronic information system and prescription evaluation system, is also troubling to the work of clinical pharmacists. Due to the development trend of medical digitalization, clinical pharmacists have been given a new mission to utilize big data to capture different information flows and integrate data, knowledge and technology [51]. Electronic information system and prescription evaluation system, as effective auxiliary tools to carry out pharmaceutical care and record data, can improve the process of prescribing and dispensing, reduce medical errors, and improve work efficiency [52]. Hospitals should strengthen the construction of electronic information system and prescription evaluation system based on current hardware facilities, and constantly improve and update them to meet the needs of clinical diagnosis and treatment in different periods and therapeutic environments.

4.2. The barriers perceived by clinical pharmacists with different characteristics

Clinical pharmacists who have not participated in training or obtained qualification certificates through other training may perceive higher level of barriers because of their lack of specialized knowledge and practical experience in standard training. As found in this study, there are many clinical pharmacists with bachelor's degree or lower education, and most of them are young with only junior or intermediate titles [9], which may cause them to lack the necessary knowledge and skills and increase errors and irregularities in their work. A Jordanian study also found that pharmacists with a higher degree were more actively involved in pharmaceutical care practice and faced fewer barriers to its implementation [41]. Therefore, the criteria for clinical pharmacists to enter the profession should be tightened. Regulations should be enacted to strengthen the continuing education system for clinical pharmacists with less training experience to improve their ability. In addition, the traditional pharmacy education in China has long been dominated by chemistry and theoretical pharmacy, which lacks clinical practice [53]. Coupled with the fact that hospitals have less training in pharmacy-related knowledge and hands-on practice, the career development and competency enhancement of clinical pharmacists is limited [54]. Other countries have also found that pharmacy graduates with a bachelor's or doctoral degree are considered unprepared to practice in most pharmacy-related settings [55,56]. It provides a clear emphasis on the importance of the cultivation of practical and applied knowledge in clinical pharmacy education. Pharmacy students should be encouraged to participate in hospital internships [57], and a full-cycle training system for on-the-job clinical pharmacists based on job competency should be established [58].

Subgroup analysis found that the level of barriers perceived by clinical pharmacists working in tertiary hospitals is higher than those in secondary hospitals. The reason may be that there are many specialized clinical departments, a wide variety of diseases, and a large number of critically ill patients in tertiary hospitals, making the development of pharmaceutical care more difficult than in secondary hospitals [59]. In addition, clinical pharmacists in tertiary hospitals undertake more complicated work, which requires more clinical knowledge and practical skills and occupies more time for pharmaceutical care and continuing education [60]. Although the staffing, hardware facilities and informationization construction of tertiary hospitals are more complete than those of secondary hospitals, they still cannot meet the more urgent demand for pharmaceutical care [21], which leads to more barriers perceived by clinical pharmacists in tertiary hospitals in terms of objective conditions. Therefore, tertiary hospitals should strengthen the introduction and training of experienced pharmaceutical personnel, and increase the investment of facilities and the level of information system construction in pharmacy departments.

In the current study, compared with male clinical pharmacists, female clinical pharmacists were more likely to perceive a lack of knowledge and skills, and a lack of support from hospital leaders and department heads. Potential reasons come from many aspects. First, due to the gender differences in self-efficacy and self-confidence, women usually underestimate their skills and professional

knowledge compared with their male counterparts [61,62]. Besides, gender bias is also one of the possible reasons [63]. Medication management recommendations made by female clinical pharmacists are less likely to be accepted by hospitalists, which may lead to female pharmacists' lack of confidence in their abilities [64]. The Law on the Guarantee of the Rights and Interests of Women has been successfully revised and promulgated in China, explicitly prohibiting gender discrimination in the workplace. As pharmacy is a field dominated by women, the supporting organizational policies should be implemented in time. Third, most female clinical pharmacists have their own families. Influenced by China's traditional concept of family, female clinical pharmacists need to balance work and family, resulting in reduced productivity and disparity in three main academic evaluation fields, namely, teaching, service and research [65]. Thus, additional barriers may be encountered. Childcare support, a favorable working environment and family support can help to balance the work and life of female pharmacists.

Unsurprisingly, clinical pharmacists with fewer years of practice have higher level of perceived barriers compared to those with more years of practice. This finding is consistent with previous studies, who suggested that younger pharmacists were more dissatisfied with their work than older pharmacists [66,67]. It may be because they have less work experience and lack the knowledge and skills needed for pharmaceutical care [68]. A study revealed that most of the clinical pharmacists acquire knowledge through dispensing activities rather than any formal undergraduate or postgraduate courses [69]. In addition, compared with their older peers, young pharmacists expect more interaction and cooperation from physicians [66]. However, physicians and patients are typically more accepting of experienced clinical pharmacists and the pharmaceutical care they provide, while they lack sufficient understanding and trust in less experienced clinical pharmacists, which makes young clinical pharmacists feel less external support [70]. It is suggested that young pharmacists should actively engage in pharmaceutical practice, accumulate enough knowledge and skills from hands-on operation to enhance the trust of physicians and patients.

4.3. Limitations

This study has some limitations. First, the convenience sampling used in this study may have resulted in a biased sample. However, this is the most efficient sampling method for the most investigators and the sociodemographic characteristics of this sample were relatively consistent with those reported in previous studies [35,36]. Therefore, the results of the study are representative to some extent. Second, the questionnaire was self-reported, hence there is potential for social desirability bias, i.e., and clinical pharmacists may underestimate their barriers to show support for the pharmaceutical care. Third, since the subjects of this study were clinical pharmacists in secondary and tertiary hospitals, caution should be exercised when extending the findings to clinical pharmacists in primary hospitals. Future research on pharmacists working in different settings could improve the understanding of pharmaceutical care barriers. Finally, this study only examined the characteristics of clinical pharmacists who perceived barriers through subgroup analyses and ANOVA test. Future studies could incorporate more relevant variables to comprehensively and rigorously explore the factors influencing pharmaceutical care barriers.

5. Conclusion

This study identified several noteworthy issues that may hinder the development of pharmaceutical care in hospitals, including lack of additional staffing, lack of time, and lack of an electronic information system and prescription evaluation system. Barriers mainly came from objective conditions. Clinical pharmacists who were without training, worked in tertiary hospitals, and had other training certificates perceived more severe pharmaceutical care barriers. Several strategies need to be implemented urgently to overcome these barriers and facilitate the development of pharmaceutical care in China. The government should legally define the responsibilities of clinical pharmacists, establish mandatory training programs to enhance the competence of clinical pharmacists, and protect the rights of female workers. Hospitals should improve hardware and software facilities for pharmaceutical care, strengthen continuing education systems, and establish strict entry criteria for clinical pharmacists. Universities should strengthen the practical training of clinical pharmacy students.

Ethics statements

This study was reviewed and approved by the Ethics Committee of China Pharmaceutical University with the approval number: CPU2019015, dated April 30, 2019.

Data availability statement

The data of this study is not deposited into a publicly available repository, because the data that has been used is confidential. For further access please contact the corresponding author.

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CRediT authorship contribution statement

Xiang Gao: Writing – original draft, Validation, Methodology, Data curation, Conceptualization. **Zhuoqi Gu:** Writing – review & editing, Supervision, Methodology, Formal analysis. **Yuankai Huang:** Software, Project administration, Methodology, Investigation. **Haotao Li:** Writing – review & editing, Methodology. **Xiaoyu Xi:** Supervision, Resources.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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