

RESEARCH

Open Access



# Knowledge, attitudes, and practices of primary healthcare practitioners regarding pharmacist clinics: a cross-sectional study in Shanghai

Xinyue Zhang<sup>1†</sup>, Zhijia Tang<sup>1†</sup>, Yanxia Zhang<sup>1†</sup>, Wai Kei Tong<sup>1</sup>, Qian Xia<sup>1</sup>, Bing Han<sup>1\*</sup> and Nan Guo<sup>1\*</sup>

## Abstract

**Background** Pharmacist clinics offer professional pharmaceutical services that can improve public health outcomes. However, primary healthcare staff in China face various barriers and challenges in implementing such clinics. To identify existing problems and provide recommendations for the implementation of pharmacist clinics, this study aims to assess the knowledge, attitudes, and practices of pharmacist clinics among primary healthcare providers.

**Methods** A cross-sectional survey based on the Knowledge-Attitude-Practice (KAP) model, was conducted in community health centers (CHCs) and private hospitals in Shanghai, China in May, 2023. Descriptive analytics and the Pareto principle were used to multiple-answer questions. Chi-square test, Fisher's exact test, and binary logistic regression models were employed to identify factors associated with the knowledge, attitudes, and practices of pharmacist clinics.

**Results** A total of 223 primary practitioners participated in the survey. Our study revealed that most of them had limited knowledge (60.1%,  $n = 134$ ) but a positive attitude (82.9%,  $n = 185$ ) towards pharmacist clinics, with only 17.0% ( $n = 38$ ) having implemented them. The primary goal of pharmacist clinics was to provide comprehensive medication guidance (31.5%,  $n = 200$ ), with medication education (26.3%,  $n = 202$ ) being the primary service, and special populations (24.5%,  $n = 153$ ) identified as key recipients. Logistic regression analysis revealed that education, age, occupation, position, work seniority, and institution significantly influenced their perceptions. Practitioners with bachelor's degrees, for instance, were more likely than those with less education to recognize the importance of pharmacist clinics in medication guidance (aOR: 7.130, 95%CI: 1.809–28.099,  $p$ -value = 0.005) and prescription reviews (aOR: 4.675, 95% CI: 1.548–14.112,  $p$ -value = 0.006). Additionally, practitioners expressed positive attitudes but low confidence, with only 33.3% ( $n = 74$ ) feeling confident in implementation. The confidence levels of male practitioners

<sup>†</sup>Xinyue Zhang, Zhijia Tang and Yanxia Zhang contributed equally to this work.

\*Correspondence:

Bing Han  
hbshcn@fudan.edu.cn  
Nan Guo  
guon@fudan.edu.cn

Full list of author information is available at the end of the article



© The Author(s) 2024. **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

surpassed those of female practitioners ( $p$ -value = 0.037), and practitioners from community health centers (CHCs) exhibited higher confidence compared to their counterparts in private hospitals ( $p$ -value = 0.008). Joint physician-pharmacist clinics (36.8%,  $n$  = 82) through collaboration with medical institutions (52.0%,  $n$  = 116) emerged as the favored modality. Daily sessions were preferred (38.5%,  $n$  = 86), and both registration and pharmacy service fees were considered appropriate for payment (42.2%,  $n$  = 94). The primary challenge identified was high outpatient workload (30.9%,  $n$  = 69).

**Conclusions** Although primary healthcare practitioners held positive attitudes towards pharmacist clinics, limited knowledge, low confidence, and high workload contributed to the scarcity of their implementation. Practitioners with diverse sociodemographic characteristics, such as education, age, and institution, showed varying perceptions and practices regarding pharmacist clinics.

**Keywords** Pharmacist clinics, Primary care, Cross-sectional study, Pharmaceutical services, Public health

## Background

Pharmacist clinics are specialized healthcare facilities that offer professional pharmaceutical services, such as medication therapy management, medication reconciliation, lifestyle counseling, and immunizations, for patients with chronic diseases or managing multiple drugs [1]. Through the provision of these services, pharmacist clinics aim to improve patient access to healthcare, optimize medication use, and improve overall public health outcomes.

Pharmacist clinics originated in the 1960s in the United States and have spread globally in recent decades [2], with a growing number of countries adopting this model of care. The World Health Organization (WHO) has recognized the importance of pharmacists in primary healthcare and encouraged the integration of pharmaceutical services into broader healthcare systems [3]. This integration facilitates the rational use of medication, thereby minimizing adverse drug events and medication errors, ultimately leading to better therapeutic outcomes. Moreover, pharmacist clinics offer medication guidance and education, which adjusts optimal medication dosage [4], enhances patient adherence [1, 5], expands access to health care [6], and reduces treatment costs [7]. These clinics effectively bridge the communication gap between physicians and pharmacists [8], fostering interdisciplinary collaboration and integrated patient care [1, 9].

The development of pharmacist clinics in China was initiated in the late 20th century, coinciding with the introduction of healthcare reforms by the Chinese government in the early 2000s. The release of “Opinions on Deepening the Reform of the Medical and Health System” [10] in 2009 highlighted the importance of pharmacist clinics and the crucial role of pharmacists in improving the quality and accessibility of healthcare services in primary settings. In 2020, the Chinese government released a guidance document titled “Opinions on Strengthening the Pharmaceutical Management of Medical Institutions and Promoting Rational Drug Use,” encouraging provinces to actively establish pharmacist clinics [11].

However, it wasn't until 2021 that the General Office of the National Health Commission developed the “Guidelines for Pharmaceutical Outpatient Services in Medical Institutions” to standardize these pharmacist clinics [12]. Despite the progress made, primary medical staff in both developed and developing countries face various challenges, especially in developing countries [13], including a shortage of qualified pharmacists [14, 15], limited recognition of pharmacists' roles among healthcare professionals and the public [16, 17], and the need for a more standardized approach to pharmaceutical care [18]. Additionally, these clinics are predominantly located in large general hospitals or specialized medical facilities, limiting their coverage to specific areas, such as antibiotics [19] and anticoagulants [20]. In rural areas, there is scarce awareness and discussion regarding the promotion of pharmacist clinics.

To date, most research on pharmacist clinics comes from countries like the United States, the UK, Canada, and Australia, focusing primarily on the outcomes of pharmacist interventions rather than the implementation challenges [1, 4, 21–24]. In China, only a few studies have assessed the current state of pharmacist clinics. Cai et al. [25], for instance, conducted a national survey revealing that just 10.03% of hospitals had pharmacist clinics. Wu et al. [26] investigated the establishment and operational details of pharmacist-managed clinics in Taiwan. However, there is no published research exploring optimal practices for setting up pharmacist clinics in China or identifying the barriers to establishing these clinics in primary healthcare settings. In this study, we aim to assess the awareness and understanding of pharmacist clinics among primary healthcare providers. We conducted a cross-sectional survey based on the Knowledge-Attitude-Practice (KAP) model to identify knowledge gaps and develop interventions to encourage interprofessional collaboration and enhance practice efficiency. The findings may also improve patient outcomes, healthcare delivery by streamlining the implementation process, and utilization of high-quality pharmaceutical services.

Our ultimate goal was to overcome barriers to advancing pharmacist clinics within China's healthcare system and offer insights for policymakers and healthcare authorities to integrate these clinics into primary healthcare settings, not only in China but potentially in other countries as well.

## Methods

### Survey instrument & selection criteria

Our study employed a structural equation model based on the Knowledge, Attitude, and Practice (KAP) theory [27] and relevant literature [28–31] to explore the relationships between various factors. Following the KAP principles, we developed a questionnaire consisting of 21 questions across three domains: (A) knowledge of pharmacist clinics, (B) attitudes towards pharmacist clinics, and (C) practices related to pharmacist clinics. Demographic information such as gender, age, education, occupation, position, seniority, department, and institution was collected through self-reporting.

The inclusion and exclusion criteria for the sampled respondents were as follows. Inclusion criteria: (1) Full-time primary healthcare practitioners attending a continuing education course at Minhang Hospital in Shanghai, China. This included physicians, pharmacists, nurses, and other primary healthcare practitioners. (2) Willingness to participate in the study and provide informed consent. Exclusion criteria: (1) Part-time employees or interns. (2) Non-medical staff. (3) Individuals who declined to sign the informed consent form.

### Study population and data source

This study used data from a cross-sectional survey conducted in May, 2023, involving primary healthcare practitioners from 10 community health centers (CHCs) and 38 private hospitals in Shanghai, China. After excluding participants from secondary or tertiary hospitals ( $n=9$ ), nursing homes ( $n=6$ ), and other facilities such as welfare homes and school clinics ( $n=9$ ), a total of 223 eligible subjects were included.

### Data collection

The sample size was optimized to range between 105 and 210, based on the recommended ratio of 5 to 10 respondents per item [32, 33]. We also performed a pilot study in April, 2023 to ensure linguistic clarity and readability of the questionnaire. Twenty-six student volunteers from the School of Pharmacy at Fudan University were recruited to refine the questionnaire. Additionally, face-to-face interviews were conducted to further assess their understanding of the content. The final version was electronically distributed to participants during a continuing education course using a voluntary sampling approach.

The full questionnaire is available in Supplementary Table 1, and all data were anonymized.

### Statistical analysis

Categorical variables were summarized using frequency counts (weighted percentage, %). The Chi-square test and Fisher's exact test were used to assess differences in knowledge, attitude, and practice regarding pharmacist clinics across various sociodemographic characteristics. Descriptive analytics and the Pareto principle were applied to multiple-answer questions. In case of rejection of the null hypothesis, multiple pairwise comparisons would be conducted as confirmatory post hoc analysis using Bonferroni correction. Based on the univariate analysis results, we constructed binary logistic regression models to calculate adjusted odds ratios (aOR) and 95% confidence intervals (CI) to reveal factors associated with perceived goals, service scope, and target recipients of pharmacist clinics.

All statistical analyses were performed using IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY, USA). A two-sided  $p$ -value  $< 0.05$  was considered statistically significant.

## Results

### Demographics

As presented in Table 1, a total of 223 primary healthcare practitioners participated in the survey, with 41.3% ( $n=92$ ) being male and 76.2% ( $n=170$ ) under 45 years old. The majority (84.3%,  $n=188$ ) were physicians, while the remaining were pharmacists. Regarding educational qualifications, 82.5% ( $n=184$ ) of respondents held a bachelor's degree or below. Furthermore, 91.9% ( $n=205$ ) held mid-level or lower positions, and 56.1% ( $n=125$ ) reported professional tenures of less than 10 years. Of these 223 practitioners, 36.8% ( $n=82$ ) were from public institutions (community health centers), and 63.2% ( $n=141$ ) were from private hospitals.

### Knowledge of pharmacist clinics

Of primary care practitioners, 84.8% ( $n=189$ ) recognized pharmacist clinics, with 24.7% ( $n=55$ ) having strong familiarity. Figure 1a-c showed practitioners' views on the goals, services, and target recipients of these clinics. The primary goal was to provide comprehensive medication guidance (31.5%,  $n=200$ ), with medication education (26.3%,  $n=202$ ) being the primary service, and special populations (24.5%,  $n=153$ ) identified as key recipients. Logistic regression results revealed several significant influential factors (Table 2).

### Education

Compared to those with less education, practitioners with bachelor's degrees were more likely to see the role

**Table 1** Sociodemographic information of respondents (N=223)

Variables	Characteristics	Frequency (n)	Percentage (%)
Gender	Male	92	41.3
	Female	131	58.7
Age, years	18–30	68	30.5
	31–45	102	45.7
	>45	53	23.8
Education	Junior college or below	48	21.5
	Bachelor's degree	136	61.0
	Master degree or above	39	17.5
Occupation	Physician	188	84.3
	Pharmacist	35	15.7
	Nurse	0	0.0
	Other	0	0.0
Department	Internal medicine	52	23.3
	Surgery	36	16.1
	General practice	39	17.5
	Traditional Chinese medicine	27	12.1
	Pharmacy	35	15.7
Work seniority, years	Other	34	15.2
	<5	59	26.5
	5–9	66	29.6
	10–19	39	17.5
Position	≥20	59	26.5
	Senior/deputy senior	18	8.1
	Intermediate	97	43.5
Institution	Junior or below	108	48.4
	Community health center	82	36.8
	Private hospital	141	63.2

of pharmacist clinics in medication guidance (aOR: 7.130, 95%CI: 1.809–28.099,  $p$ -value=0.005), prescription reviews (aOR: 4.675, 95% CI: 1.548–14.112,  $p$ -value=0.006), and serving patients on high-risk drugs (aOR: 2.824, 95% CI: 1.090–7.316,  $p$ -value=0.033).

Besides medication guidance (aOR: 7.303, 95%CI: 1.343–39.720,  $p$ -value=0.021), practitioners with master's or higher degrees preferred adherence interventions (aOR: 4.221, 95%CI: 1.339–13.300,  $p$ -value=0.014), follow-up services (aOR: 3.125, 95%CI: 1.095–8.915,  $p$ -value=0.033), and catering to patients with  $\geq 2$  chronic diseases (aOR: 6.401, 95%CI: 1.233–33.223,  $p$ -value=0.027) or  $\geq 5$  medications (aOR: 3.987, 95%CI: 1.250–12.717,  $p$ -value=0.019). Higher education was also inversely associated with emphasizing patients needing test report interpretations (aOR < 1,  $p$ -value < 0.05).

### Age

Younger practitioners, aged 18 to 30, considered pharmacist clinics as tools to mitigate physician-patient

conflicts through improved communication compared to those aged  $\geq 46$  (aOR: 0.165, 95%CI: 0.028–0.988,  $p$ -value=0.048).

### Occupation

Compared to physicians, pharmacists typically addressed all patients as recipients (aOR: 3.322, 95%CI: 1.031–10.703,  $p$ -value=0.044), but were less likely to offer drug regimen adjustments (aOR: 0.210, 95%CI: 0.088–0.500,  $p$ -value < 0.001).

### Position

Junior and intermediate-level practitioners demonstrated a greater likelihood for follow-up services (aOR<sub>1</sub>: 5.832, 95%CI: 1.308–25.998,  $p$ -value=0.021; aOR<sub>2</sub>: 3.99, 95%CI: 1.087–14.646,  $p$ -value=0.037), and were less likely to target patients in need of test report interpretations (aOR<sub>1</sub>: 0.172, 95%CI: 0.038–0.781,  $p$ -value=0.023; aOR<sub>2</sub>: 0.287, 95%CI: 0.082–0.997,  $p$ -value=0.049) than their senior counterparts.

### Work seniority

Practitioners with 10–19 years of work experience were significantly more likely to consider isolated/empty-nest patients as suitable recipients compared to those with <5 years of experience (aOR: 3.328, 95%CI: 1.021–10.849,  $p$ -value=0.046).

### Institution

Practitioners from CHCs were more likely to view frequent drug collectors as suitable recipients compared to those from private hospitals (aOR: 0.359, 95%CI: 0.134–0.966,  $p$ -value=0.043).

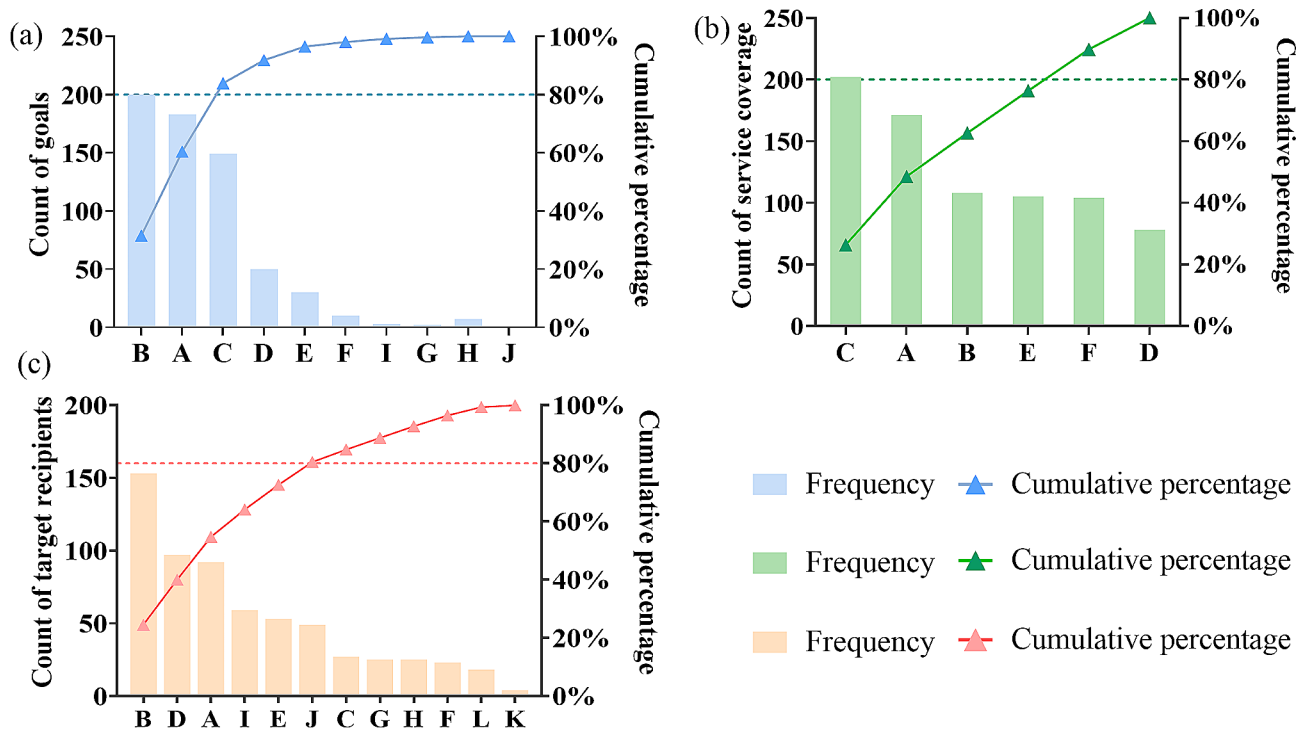
### Attitude of pharmacist clinics

#### Necessity and confidence in implementing pharmacist clinics

Table 3 showed that 82.9% ( $n=185$ ) of practitioners recognized the necessity of pharmacist clinics, but only 33.3% ( $n=75$ ) felt confident in their implementation. Male practitioners exhibited significantly higher confidence levels compared to female practitioners ( $p=0.037$ ), and practitioners from community health centers (CHCs) showed greater confidence relative to those practicing in private hospitals ( $p=0.008$ ).

#### Preferred mode of pharmacist clinics

As shown in Table 4, the favored modality was found to be joint physician-pharmacist clinics (36.8%,  $n=82$ ), through collaboration with medical institutions (52.0%,  $n=116$ ). Daily sessions emerged as the preferred frequency ( $n=86$ , 38.5%), with both registration and pharmacy service fees considered appropriate for payment (42.2%,  $n=94$ ).



**Fig. 1** Pareto chart demonstrating respondents' knowledge of pharmacist clinics

(a) Perceived goals: **A** prescription reviews, **B** medication guidance, **C** time-saving, **D** conflict alleviation, **E** patient empowerment, **F** cost reduction, **G** role enhancement, **H** research, **I** training, and **J** no perceived value  
 (b) Perceived service scope: **A** drug regimen adjustments, **B** medication reconciliation, **C** medication education on dosage, side effects, and interactions, **D** adherence interventions, **E** health promotion, **F** patient follow-ups  
 (c) Perceived target recipients: **A** isolated/empty-nest patients, **B** special populations (e.g. elderly, children, pregnant, and liver/kidney-impaired), **C** economically disadvantaged patients, **D** patients suffering from adverse reactions, **E** patients needing test report interpretations, **F** frequent drug collectors (> 20 times/year), **G** patients with  $\geq 2$  chronic diseases, **H** patients with any chronic diseases, **I** patients on  $\geq 5$  medications, **J** high-risk drug users (e.g. psychotropic drugs, hormones, injections, and inhalants), **K** patients under contract with family physicians, and **L** all patients

Furthermore, we explored the influence of different sociodemographic variables. Practitioners holding a master's degree or higher demonstrated a preference for a clinic frequency of 2–4 times per week ( $p$ -value=0.015), along with acceptance of both registration and pharmacy service fees ( $p$ -value<0.001), compared to those with lower levels of education. Conversely, those with a junior college education or below were more willing to seek free services. Practitioners from CHCs exhibited a preference for weekly or 2–4 times per week clinics, whereas those from private hospitals favored daily or monthly sessions ( $p$ -value<0.001).

#### Practice of pharmacist clinics

As shown in Table 5, there was a limited prevalence of pharmacist clinics within primary care institutions. Only 17.0% ( $n=38$ ) of practitioners reported the implementation of pharmacy clinics, mostly scheduled once a week (47.4%,  $n=18$ ), with the primary challenge being a high outpatient workload (30.9%,  $n=69$ ). Practitioners from CHCs demonstrated a significantly higher

implementation frequency compared to those from private hospitals ( $p$ -value<0.001).

We further explored sociodemographic factors associated with challenges. Practitioners aged over 45 years ( $P=0.020$ ) and occupying senior/deputy senior positions ( $p$ -value=0.018) were more likely to consider the absence of fee collection mechanisms as the principal difficulty, as opposed to their younger counterparts and those in lower positions.

#### Discussion

Our study aims to evaluate the perceptions, attitudes, and practices of primary healthcare practitioners regarding pharmacist clinics and to identify necessary changes. The findings unveiled a lack of knowledge and confidence among primary care providers, who are faced with barriers including high outpatient workloads and concerns related to professionalism. Collaborative models are preferred as they align with the current emphasis on multidisciplinary approaches in modern healthcare, which aim to achieve optimal population health [34]. Additionally,

**Table 2** Factors influencing perceived goals, service scope, and target recipients of pharmacist clinics (N=223)

Factors	Reference	Characteristics	Items	Odds Ratio (95% CI)	Adjusted p-value	Hosmer-Lemeshow Good of Fit test		
						Chi-square	p-value	
Education	Junior college or below	Bachelor	Goal	Prescription reviews	4.675 (1.548–14.112)	0.006	6.273	0.617
				Medication guidance	7.130 (1.809–28.099)	0.005	7.144	0.521
			Recipient	Patients needing test report interpretations	0.384 (0.159–0.928)	0.034	3.899	0.866
				High-risk drug users	2.824 (1.090–7.316)	0.033	6.730	0.566
				Medication guidance	7.303 (1.343–39.720)	0.021	7.144	0.521
	Master or above	Goal	Medication guidance	4.221 (1.339–13.300)	0.014	11.443	0.178	
			Adherence interventions	3.125 (1.095–8.915)	0.033	5.486	0.705	
		Recipient	Follow-up visits	0.126 (0.032–0.505)	0.003	3.899	0.866	
			Patients needing test report interpretations	6.401 (1.233–33.223)	0.027	7.581	0.475	
			Patients with ≥ 2 chronic diseases	3.987 (1.250–12.717)	0.019	5.98	0.649	
Age	18–30 years old	≥ 46 years old	Goal	Conflict alleviation	0.165(0.028–0.988)	0.048	5.618	0.690
				Occupation	Physician	Pharmacist	Service	Drug regimen adjustments
Recipient	All patients	3.322 (1.031–10.703)	0.044					6.131
	Position	Senior/ deputy senior	Intermediate	Service	Follow-up visits	3.990 (1.087–14.646)	0.037	5.486
Patients needing test report interpretations					0.287 (0.082–0.997)	0.049	3.899	0.866
Junior or below				Service	Follow-up visits	5.832 (1.308–25.998)	0.021	5.486
		Recipient	Patients needing test report interpretations		0.172 (0.038–0.781)	0.023	3.899	0.866
		High-risk drug users	18.391 (1.686–200.604)	0.017	6.730	0.566		
Work seniority		<5 years	10–19 years	Recipient	Isolated/empty-nest patients	3.328 (1.021–10.849)	0.046	5.209
	Frequent drug collectors				0.359 (0.134–0.966)	0.043	5.666	0.685
Institution	Community health center	Private hospital						

The model incorporated variables including gender, age, education, occupation, position, work seniority, and institution. The variable “department” was excluded due to inadequate model fit. Only significant findings were presented

**Table 3** Primary healthcare practitioners’ attitude toward conducting pharmacist clinics, n (%)

Items	Totally agree	Agree	Uncertain	Disagree	Totally disagree	P-value
Necessity	96 (43.0)	89 (39.9)	36 (16.1)	2 (0.9)	0 (0.0)	*
Confidence	23 (10.3)	52 (23.3)	81 (36.3)	53 (23.8)	14 (6.3)	
<i>Gender</i>						0.037
Male	11 (12.0)	24 (26.1)	35 (38.0)	13 (14.1)	9 (9.8)	
Female	12 (9.2)	28 (21.4)	46 (35.1)	40 (30.5)	5 (3.8)	
<i>Institution</i>						0.008
CHC	13 (15.9)	26 (31.7)	27 (32.9)	14 (17.1)	2 (2.4)	
Private hospital	10 (7.1)	26 (18.4)	54 (38.3)	39 (27.7)	12 (8.5)	

\*No significant differences were observed among all subgroups

our findings highlight the impact of institution and gender on the perceptions of primary care providers.

In this study, more practitioners preferred joint physician-pharmacist clinics over traditional physician-led clinics (36.8%,  $n=82$  vs. 24.2%,  $n=54$ ), which is in line with a global focus on integrating pharmacists into the

provision of patient-centered, coordinated, and comprehensive care [1, 35, 36]. Primary care physicians are in short supply, and studies unveiled that the shortage of primary care physicians has led to increased workloads and a greater demand for medication guidance services, especially among vulnerable patients aged 65 and above

**Table 4** Correlation of preferred mode of pharmacist clinics with education and institution

Items	Contents	Education			P-value	Institution		P-value
		Junior college or below	Bachelor	Master or above		Community health center	Private hospital	
Modality	Physician-guided traditional clinic	14 (29.2)	31 (22.8)	9 (23.1)	0.751	22 (26.8)	32 (22.7)	0.848
	Independent pharmacist clinic	2 (4.2)	12 (8.8)	1 (2.6)		5 (6.1)	10 (7.1)	
	Joint physician-pharmacist clinic	15 (31.2)	49 (36.0)	18 (46.2)		31 (37.8)	51 (36.2)	
	Multidisciplinary clinic involving physicians, pharmacists, nurses, and nutritionists	15 (31.2)	40 (29.4)	11 (28.2)		23 (28.0)	43 (30.5)	
	Lectures/consultation sessions; no scheduled clinics	2 (1.2)	4 (2.9)	0 (0.0)		1 (1.2)	5 (3.5)	
Approach	Collaboration with research institutions	9 (18.8)	24 (17.6)	8 (20.5)	0.315	19 (23.2)	22 (15.6)	0.309
	Collaboration with medical institutions	20 (41.7)	70 (51.5)	26 (66.7)		41 (50.0)	75 (53.2)	
	Collaboration with enterprises	4 (8.3)	10 (7.4)	2 (5.1)		3 (3.7)	13 (9.2)	
	Collaboration with industry associations	12 (25.0)	19 (14.0)	2 (5.1)		11 (13.4)	22 (15.6)	
	Independent operation	3 (6.2)	12 (8.8)	1 (2.6)		8 (9.8)	8 (5.7)	
	Other	0 (0.0)	1 (0.7)	0 (0.0)		0 (0.0)	1 (0.7)	
Frequency	Daily	16 <sub>a</sub> (33.4)	60 <sub>a</sub> (44.2)	10 <sub>a</sub> (25.7)	0.015	21 (25.6)	65 (46.1)	<0.001
	2–4 times per week	10 <sub>a,b</sub> (20.8)	24 <sub>b</sub> (17.6)	17 <sub>a</sub> (43.6)		25 <sub>a</sub> (30.5)	26 <sub>b</sub> (18.4)	
	Weekly	12 <sub>a</sub> (25.0)	35 <sub>a</sub> (25.7)	11 <sub>a</sub> (28.2)		32 <sub>a</sub> (39.0)	26 <sub>b</sub> (18.4)	
	Once every two weeks	4 <sub>a</sub> (8.3)	3 <sub>a</sub> (2.2)	1 <sub>a</sub> (2.6)		2 <sub>a</sub> (2.4)	6 <sub>a</sub> (4.3)	
	Monthly	5 <sub>a</sub> (10.4)	13 <sub>a</sub> (9.6)	0 <sub>a</sub> (0.0)		2 <sub>a</sub> (2.4)	16 <sub>b</sub> (11.3)	
	Other (please specify ____)	1 <sub>a</sub> (2.1)	1 <sub>a</sub> (0.7)	0 <sub>a</sub> (0.0)		0 <sub>a</sub> (0.0)	2 <sub>a</sub> (1.4)	
Payment	Registration and pharmacy service fees	12 <sub>a</sub> (25.0)	57 <sub>a</sub> (41.9)	25 <sub>b</sub> (64.1)	<0.001	36 (43.4)	58 (41.1)	0.634
	Only registration fees determined by provider positions	6 <sub>a</sub> (12.5)	18 <sub>a</sub> (13.2)	6 <sub>a</sub> (15.4)		11 (13.3)	19 (13.5)	
	Only registration fees determined by institution levels	15 <sub>a</sub> (31.2)	47 <sub>a</sub> (34.6)	7 <sub>a</sub> (17.9)		27 (33.7)	42 (29.8)	
	No fee should be charged	15 <sub>a</sub> (31.2)	14 <sub>b</sub> (10.3)	1 <sub>b</sub> (2.6)		8 (9.6)	22 (15.6)	

Each subscript letter denotes a subset of education-level categories whose column proportions do not differ significantly from each other at the 0.05 level

**Table 5** Correlation of practice of pharmacist clinics with age and position

Items	Contents	Age, years			P-value	Position			P-value
		18–30	31–45	>45		Senior/deputy senior	Intermediate	Junior or below	
Frequency	Daily	3 (4.4)	4 (3.9)	0 (0.0)	0.782	0 (0.0)	5 (5.2)	2 (1.9)	0.716
	2–4 times per week	1 (1.5)	3 (2.9)	1 (1.9)		1 (5.6)	3 (3.1)	1 (0.9)	
	Weekly	4 (5.9)	8 (7.8)	6 (11.3)		2 (11.1)	7 (7.2)	9 (8.3)	
	Once every two weeks	1 (1.5)	1 (1.0)	1 (1.9)		0 (0.0)	2 (2.1)	1 (0.9)	
	Monthly	0 (0.0)	3 (2.9)	1 (1.9)		0 (0.0)	1 (1.0)	3 (2.8)	
	Other	1 (1.5)	0 (0.0)	0 (0.0)		0 (0.0)	1 (1.0)	0 (0.0)	
Challenges	Insufficient professionalism	15 <sub>a</sub> (22.1)	30 <sub>a</sub> (29.4)	11 <sub>a</sub> (20.8)	0.020	5 <sub>a</sub> (27.8)	23 <sub>a</sub> (23.7)	28 <sub>a</sub> (25.9)	0.018
	High outpatient workload	24 <sub>a</sub> (35.3)	29 <sub>a</sub> (28.4)	16 <sub>a</sub> (30.2)		2 <sub>a</sub> (11.1)	28 <sub>a</sub> (28.9)	39 <sub>a</sub> (36.1)	
	Limited patient volume	14 <sub>a</sub> (20.6)	24 <sub>a</sub> (23.5)	11 <sub>a</sub> (20.8)		5 <sub>a</sub> (27.8)	27 <sub>a</sub> (27.8)	17 <sub>a</sub> (15.7)	
	Lack of leadership attention	0 <sub>a</sub> (0.0)	3 <sub>a</sub> (2.9)	2 <sub>a</sub> (3.8)		0 <sub>a</sub> (0.0)	2 <sub>a</sub> (2.1)	3 <sub>a</sub> (2.8)	
	Weak inter-department collaboration	1 <sub>a</sub> (1.5)	5 <sub>a</sub> (4.9)	1 <sub>a</sub> (1.9)		1 <sub>a</sub> (5.6)	4 <sub>a</sub> (4.1)	2 <sub>a</sub> (1.9)	
	Space constraints	5 <sub>a</sub> (7.4)	6 <sub>a</sub> (5.9)	1 <sub>a</sub> (1.9)		1 <sub>a</sub> (5.6)	3 <sub>a</sub> (3.1)	8 <sub>a</sub> (7.4)	
	Absence of fee collection mechanisms	1 <sub>a</sub> (1.5)	1 <sub>a</sub> (1.0)	8 <sub>b</sub> (15.1)		2 <sub>a</sub> (11.1)	7 <sub>a,b</sub> (7.2)	1 <sub>b</sub> (0.9)	
	Low staff motivation	8 <sub>a</sub> (11.8)	4 <sub>a</sub> (3.9)	2 <sub>a</sub> (3.8)		1 <sub>a</sub> (5.6)	3 <sub>a</sub> (3.1)	10 <sub>a</sub> (9.3)	
	No significant difficulties identified	0 <sub>a</sub> (0.0)	0 <sub>a</sub> (0.0)	1 <sub>a</sub> (1.9)		1 <sub>a</sub> (5.6)	0 <sub>a,b</sub> (0.0)	0 <sub>b</sub> (0.0)	

Each subscript letter denotes a subset of education-level categories that do not differ significantly from each other at the 0.05 level. Only statistically significant results were presented

[37–40]. Our study showed the primary goals of pharmacist clinics were found to be prescription reviews (28.9%,  $n=183$ ) and medication guidance (31.5%,  $n=200$ ), which are critical in addressing concerns regarding poorly managed or duplicate prescriptions [41, 42]. Integrating pharmaceutical services into primary care offers expedited access and convenience for patients, thereby releasing physicians to focus on more complex cases and reducing their workload [43, 44]. These services also contribute to overall savings in healthcare and medication costs, as well as reduced general physician appointments, emergency department visits, and inappropriate drug use [45, 46]. Our findings support the potential of pharmacist-led prescription reviews in reducing duplicate prescriptions [47], drug-related problems [48], and medication costs, without increasing physicians' workload [49]. Moreover, pharmacist-led medication guidance provided to other professionals has been shown to reduce medication errors and inappropriate prescriptions compared to standard care [50, 51]. The development of joint physician-pharmacist clinics may be an advantageous choice for the development of pharmacist clinics in the future.

Current evidence highlights the suboptimal quality of primary care in China [52], with previous research suggesting that inadequate education and training pose significant challenges in enhancing care quality [53]. Primary healthcare providers in China have reported being too busy for continued education, dissatisfaction with course content, and having unqualified supervisors [54]. This issue seems to be consistent in the United States [55], Canada [56], and Belgium [57]. Moreover, our study has identified high workload (30.9%,  $n=69$ ) and insufficient professionalism (25.1%,  $n=56$ ) as the top two challenges faced by pharmacist clinics. On the other hand, insufficient knowledge may contribute to negative attitudes [39].

In this study, a minority of practitioners (24.7%,  $n=55$ ) demonstrated strong familiarity, and only 33.3% ( $n=75$ ) felt confident. While some global studies did not find a significant difference in clinical competence confidence between public and private practitioners [58, 59], our study revealed that pharmacists from CHCs exhibited greater confidence in conducting pharmacist clinics compared to those from private hospitals, partially due to their greater exposure to training. Studies have also shown that community pharmacists, through enhanced training, can acquire expanded expertise and knowledge [60, 61], leading to improved service quality in primary care [62, 63]. Future efforts should focus on establishing a more efficient learning and continued education system for community practitioners in China [52].

Several impediments were identified by respondents, including limited patient volume (22.0%,  $n=49$ ) and low staff motivation (6.3%,  $n=14$ ). Despite the positive

impact of pharmacists in outpatient settings on patient outcomes, the adoption of these services remains low [1]. Recent literature has highlighted public uncertainty about primary care specialties and skepticism regarding their capacity to deliver comprehensive care [64]. Evidence suggests a lack of awareness, demand, and utilization of community pharmacy services among patients [65, 66]. Another barrier is the prevailing focus on quantity rather than quality of care, with job content and bonuses linked more to quantity than the quality of care delivered [52, 67]. Financial conflicts over funding and the absence of fee collection may also hinder collaboration between pharmacists and other healthcare providers [43, 68]. Additionally, the implementation of the zero-mark-up drug policy in China in 2011 caused a substantial decrease of about 40% in drug-related incomes [69]. Institutions responded by scaling back clinical care services to offset this profit loss [70], leading to an uptick in hospital visits for minor ailments and further burdening the healthcare system [53]. It is important to expand community pharmacy services by establishing reimbursement mechanisms to relieve the burden on general practice [71]. Countries like Australia, the UK, New Zealand, and Canada have established systems for pharmacist remuneration [72]. Payment models for pharmaceutical services typically include fee-for-service, where providers are compensated based on the services delivered (as seen in Australia, Canada, Belgium, and Japan), capitation, where providers receive a fixed amount per patient (as in the US, Thailand, and Denmark), and blended funding, which combines government and private payments (as in China, Australia, New Zealand, and Canada) [73]. Despite the existence of various payment models for pharmaceutical services, there is no standardized pricing for pharmacist clinics. Among 465 hospitals with pharmacist clinics, only 98 (21.08%) owned charging mechanisms [25]. Various studies have explored the willingness to pay (WTP) for pharmaceutical services in different countries. For instance, Porteous et al. [74] found a WTP of \$69.19 for community practices in the UK. Tsao et al. [75] reported a WTP of \$21.26 for medication therapy management in Canada, and in Brazil, the estimated WTP for comprehensive medication management was \$17.75 [76].

Our findings also revealed gender-based disparities in the perceptions and implementation of pharmacist clinics. Female practitioners exhibited lower levels of confidence in conducting the clinics compared to males, consistent with previous research indicating that women in healthcare often perceive deficiencies in their abilities despite no differences in clinical performance between genders [77]. Additionally, female medical students reported higher levels of anxiety, stress, and self-doubt about their knowledge and performance [78]. However,



in Australia and Ireland, females rated themselves higher than males in self-assessment tests [79, 80]. Further investigations to explore potential confounding factors, such as cultural influences, may contribute to understanding these variations and better address the need to tailor pharmacist-managed clinic services based on institutional needs [81].

This research is geographically confined to Shanghai and solely captures the perspectives of practitioners, potentially limiting generalizability. Future studies should broaden their scope to encompass diverse practices and include patients' perceptions. The cross-sectional design used in this study restricts the evaluation of cause-effect relationships, emphasizing the need for longitudinal investigations. Despite these limitations, to the best of the authors' knowledge, this is the first quantitative study that has examined the knowledge, attitudes, and practice of practitioners regarding pharmacist clinics in primary settings based on real-world data in China. The identified challenges in conducting these clinics provide valuable insights for policymakers, researchers, and institutions in this field.

## Conclusion

Although primary healthcare practitioners generally hold positive attitudes towards pharmacist clinics, limited knowledge and confidence, high workload, and other factors lead to the scarcity of such clinics. Practitioners with diverse sociodemographic backgrounds, especially those from different institutions and genders, exhibit varying perceptions of the forms of pharmacist clinics. Further exploration with larger samples from different regions and service recipients is necessary.

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12913-024-11136-3>.

Supplementary Material 1

## Acknowledgements

We thank all the participants in this research.

## Author contributions

ZT and YZ designed the research, developed the questionnaire; WT and QX collected the data; XZ and ZT performed the statistical analysis and wrote the manuscript; BH and NG critically reviewed the statistical analysis, work, and this report. All authors read and approved the final manuscript.

## Funding

This study received funding from the Shanghai Committee of Science and Technology (Grant No. 22YF1439800) and the Shanghai Municipal Health Commission (Grant No. 20194Y0234).

## Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

### Ethics approval and consent to participate

According to the ethics committee of Minhang Hospital, this study was exempt from ethical approval as the anonymous distribution of questionnaires minimized the risk to participants by avoiding the collection of personally identifiable information. In adherence to the Helsinki Declaration, all participants were fully informed about the study's purpose, potential privacy risks, corresponding safeguards, and provided their informed consent. Stringent measures were implemented to ensure the confidentiality of the survey data.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

### Author details

<sup>1</sup>Minhang Hospital & Department of Clinical Pharmacy, School of Pharmacy, Fudan University, 170 Xinsong Road, Shanghai 201199, P.R. China

Received: 3 February 2024 / Accepted: 22 May 2024

Published online: 29 May 2024

## References

1. Tan EC, Stewart K, Elliott RA, George J. Pharmacist services provided in general practice clinics: a systematic review and meta-analysis. *Res Social Adm Pharm.* 2014;10(4):608–22.
2. Weiss GL. *Grassroots medicine: The story of America's free health clinics.* Rowman & Littlefield; 2006.
3. Organization WH. *Towards Access 2030: WHO Medicines and Health Products Programme Strategic Framework 2016–2030.* 2017. 2018.
4. Aspinall SL, Cunningham FE, Zhao X, Boresi JS, Tonnu-Mihara IQ, Smith KJ, et al. Impact of pharmacist-managed erythropoiesis-stimulating agents clinics for patients with non-dialysis-dependent CKD. *Am J Kidney Dis.* 2012;60(3):371–9.
5. Johnson CL, Nicholas A, Divine H, Perrier DG, Blumenschein K, Steinke DT. Outcomes from DiabetesCARE: a pharmacist-provided diabetes management service. *J Am Pharm Assoc (2003).* 2008;48(6):722–30.
6. Goad JA, Taitel MS, Fensterheim LE, Cannon AE. Vaccinations administered during off-clinic hours at a national community pharmacy: implications for increasing patient access and convenience. *Ann Fam Med.* 2013;11(5):429–36.
7. Gray DR, Garabedian-Ruffalo SM, Chretien SD. Cost-justification of a clinical pharmacist-managed anticoagulation clinic. *Ann Pharmacother.* 2007;41(3):496–501.
8. Lodwick AD, Sajbel TA. Patient and physician satisfaction with a pharmacist-managed anticoagulation clinic: implications for managed care organizations. *Manag Care.* 2000;9(2):47–50.
9. Snoswell CL, Cossart AR, Chevalier B, Barras M. Benefits, challenges and contributors to the introduction of new hospital-based outpatient clinic pharmacist positions. *Explor Res Clin Soc Pharm.* 2022;5:100119.
10. Communist Party of China (CPC). Central Committee, Council. *S. Opinions on deepening the reform of the medical and health system 2009.* Accessed 1 May 2024. Accessible [https://www.gov.cn/jrzq/2009-04/06/content\\_1278721.htm](https://www.gov.cn/jrzq/2009-04/06/content_1278721.htm). Accessed 1 May 2024.
11. Notice of the Ministry of Education, the Ministry of Finance, the Ministry of Human Resources and Social Security, the medical insurance bureau, and the drug administration. *Opinions on strengthening the pharmaceutical management of medical institutions and promoting rational drug use.* Bull State Council People's Repub China. 2020(18):43–6.
12. General Office of the National Health Commission. *Guidelines for pharmaceutical outpatient services in medical institutions.* (Oct, 9, 2021). Accessed 1 May 2024. Accessible <http://www.nhc.gov.cn/yzygj/s7659/202110/f76fc77acd87458f950c86d7bc468f22.shtml>.
13. Hanson K, Brikci N, Erlangga D, Alebachew A, De Allegri M, Balabanova D, et al. The Lancet global health commission on financing primary health care: putting people at the centre. *Lancet Global Health.* 2022;10(5):e715–72.

14. Liu JX, Goryakin Y, Maeda A, Bruckner T, Scheffler R. Global health workforce labor market projections for 2030. *Hum Resour Health*. 2017;15(1):11.
15. Chen G, Sang L, Rong J, Yan H, Liu H, Cheng J, et al. Current status and related factors of turnover intention of primary medical staff in Anhui Province, China: a cross-sectional study. *Hum Resour Health*. 2021;19(1):23.
16. Robertson HD, Elliott AM, Burton C, Iversen L, Murchie P, Porteous T, et al. Resilience of primary healthcare professionals: a systematic review. *Br J Gen Pract*. 2016;66(647):e423–33.
17. Bradley F, Elvey R, Ashcroft DM, Hassell K, Kendall J, Sibbald B, et al. The challenge of integrating community pharmacists into the primary health care team: a case study of local pharmaceutical services (LPS) pilots and interprofessional collaboration. *J Interprof Care*. 2008;22(4):387–98.
18. Azhar S, Hassali MA, Ibrahim MI, Ahmad M, Masood I, Shafie AA. The role of pharmacists in developing countries: the current scenario in Pakistan. *Hum Resour Health*. 2009;7:54.
19. Blanchette L, Gauthier T, Heil E, Klepser M, Kelly KM, Nailor M, et al. The essential role of pharmacists in antibiotic stewardship in outpatient care: an official position statement of the society of infectious diseases pharmacists. *J Am Pharmacists Association*. 2018;58(5):481–4.
20. Pedersen CA, Schneider PJ, Scheckelhoff DJ. ASHP national survey of pharmacy practice in hospital settings: prescribing and transcribing—2013. *Am J health-system Pharm*. 2014;71(11):924–42.
21. de Barra M, Scott CL, Scott NW, Johnston M, de Bruin M, Nkansah N, et al. Pharmacist services for non-hospitalised patients. *Cochrane Database Syst Rev*. 2018;9(9):Cd013102.
22. Tan EC, Stewart K, Elliott RA, George J. Pharmacist services provided in general practice clinics: a systematic review and meta-analysis. *Res Social Administrative Pharm*. 2014;10(4):608–22.
23. Hindi AM, Schafheutle EI, Jacobs S. Patient and public perspectives of community pharmacies in the United Kingdom: a systematic review. *Health Expect*. 2018;21(2):409–28.
24. Sudeshika T, Naunton M, Deeks LS, Thomas J, Peterson GM, Kosari S. General practice pharmacists in Australia: a systematic review. *PLoS ONE*. 2021;16(10):e0258674.
25. Cai M, Zhou L, Gao D, Mei D, Zhang B, Zuo W, et al. A national survey of individualized pharmaceutical care practice in Chinese hospitals in 2019. *Front Pharmacol*. 2023;14:1022134.
26. Wu SE, Wen MJ, Chen JH, Shen WC, Chang EH. A qualitative study on the development of pharmacist-managed clinics in Taiwan. *J Clin Pharm Ther*. 2021;46(4):966–74.
27. Cleland J. A critique of KAP studies and some suggestions for their improvement. *Stud Fam Plann*. 1973;4(2):42–7.
28. Hajj A, Hallit S, Ramia E, Salameh P. Subcommittee OPSCMS. Medication safety knowledge, attitudes and practices among community pharmacists in Lebanon. *Curr Med Res Opin*. 2018;34(1):149–56.
29. Jarab AS, Al-Qerem W, Mukattash TL, Abuhishmah SR, Alkhdour S. Pharmacists' knowledge and attitudes toward medication therapy management service and the associated challenges and barriers for its implementation. *Saudi Pharm J*. 2022;30(6):842–8.
30. Evans RM, Bromfield LE, Brown P-GLT. An investigation of knowledge, attitude, and practice of community pharmacists toward pharmaceutical care in private community pharmacies in Jamaica. *Trop J Pharm Res*. 2021;20(12).
31. Chen L, Liu Y, Xi X. Study of knowledge, attitude and practice regarding patient education in hypertension among community pharmacists in China. *BMC Health Serv Res*. 2022;22(1):1295.
32. Kline RB. Principles and practice of structural equation modeling. 3th ed. Guilford Press; 2011.
33. Nunnally JC. Psychometric theory. 1967.
34. Anderson S. The state of the world's pharmacy: a portrait of the pharmacy profession. *J Interprof Care*. 2002;16(4):391–404.
35. Ham C. Next steps on the NHS five year forward view. *British Medical Journal Publishing Group*; 2017.
36. Salgado TM, Rosenthal MM, Coe AB, Kaefler TN, Dixon DL, Farris KB. Primary healthcare policy and vision for community pharmacy and pharmacists in the United States. *Pharm Pract (Granada)*. 2020;18(3):2160.
37. Colleges AoAM. U.S. physician shortage growing 2020. Accessed 20 Dec 2024. Accessible <https://www.aamc.org/news/us-physician-shortage-growing>.
38. Hobbs FDR, Bankhead C, Mukhtar T, Stevens S, Perera-Salazar R, Holt T, et al. Clinical workload in UK primary care: a retrospective analysis of 100 million consultations in England, 2007–14. *Lancet*. 2016;387(10035):2323–30.
39. Doherty AJ, Atherton H, Boland P, Hastings R, Hives L, Hood K et al. Barriers and facilitators to primary health care for people with intellectual disabilities and/or autism: an integrative review. *BJGP open*. 2020;4(3).
40. Baird B, Charles A, Honeyman M, Maguire D, Das P. Understanding pressures in general practice. King's Fund London; 2016.
41. Harris CM, Dajda R. The scale of repeat prescribing. *Br J Gen Pract*. 1996;46(412):649–53.
42. De Smet PA, Dautzenberg M. Repeat prescribing: scale, problems and quality management in ambulatory care patients. *Drugs*. 2004;64(16):1779–800.
43. Hindi AMK, Schafheutle EI, Jacobs S. Community pharmacy integration within the primary care pathway for people with long-term conditions: a focus group study of patients', pharmacists' and GPs' experiences and expectations. *BMC Fam Pract*. 2019;20(1):26.
44. Mathers N. General practice forward view: a new charter for general practice? *Brit J Gen Pract*. 2016;500–1.
45. Hayhoe B, Cespedes JA, Foley K, Majeed A, Ruzangi J, Greenfield G. Impact of integrating pharmacists into primary care teams on health systems indicators: a systematic review. *Br J Gen Pract*. 2019;69(687):e665–74.
46. Anderson K, Foster M, Freeman C, Luetsch K, Scott I. Negotiating unmeasurable harm and benefit: perspectives of general practitioners and consultant pharmacists on deprescribing in the primary care setting. *Qual Health Res*. 2017;27(13):1936–47.
47. Vinks TH, Egberts TC, de Lange TM, de Koning FH. Pharmacist-based medication review reduces potential drug-related problems in the elderly: the SMOG controlled trial. *Drugs Aging*. 2009;26(2):123–33.
48. Huiskes VJB, van den Ende CHM, Kruijtbosch M, Ensing HT, Meijs M, Meijs VMM, et al. Effectiveness of medication review on the number of drug-related problems in patients visiting the outpatient cardiology clinic: a randomized controlled trial. *Br J Clin Pharmacol*. 2020;86(1):50–61.
49. Zermansky AG, Petty DR, Raynor DK, Freemantle N, Vail A, Lowe CJ. Randomised controlled trial of clinical medication review by a pharmacist of elderly patients receiving repeat prescriptions in general practice. *BMJ*. 2001;323(7325):1340–3.
50. Jaam M, Naserallah LM, Hussain TA, Pawluk SA. Pharmacist-led educational interventions provided to healthcare providers to reduce medication errors: a systematic review and meta-analysis. *PLoS ONE*. 2021;16(6):e0253588.
51. Martin P, Tamblin R, Benedetti A, Ahmed S, Tannenbaum C. Effect of a pharmacist-led educational intervention on inappropriate medication prescriptions in older adults: the D-PRESCRIBE randomized clinical trial. *JAMA*. 2018;320(18):1889–98.
52. Li X, Lu J, Hu S, Cheng KK, De Maeseneer J, Meng Q, et al. The primary healthcare system in China. *Lancet*. 2017;390(10112):2584–94.
53. Li X, Krumholz HM, Yip W, Cheng KK, De Maeseneer J, Meng Q, et al. Quality of primary health care in China: challenges and recommendations. *Lancet*. 2020;395(10239):1802–12.
54. Liang S, Deng H, Liu S, Wang G, Li L, Wang M, et al. Competency building for lay health workers is an intangible force driving basic public health services in Southwest China. *BMC Health Serv Res*. 2019;19(1):596.
55. Agarwal SD, Pabo E, Rozenblum R, Sherritt KM. Professional dissonance and burnout in primary care: a qualitative study. *JAMA Intern Med*. 2020;180(3):395–401.
56. Moroz N, Moroz I, D'Angelo MS, editors. Mental health services in Canada: barriers and cost-effective solutions to increase access. Healthcare management forum. Los Angeles: SAGE Publications Sage CA; 2020.
57. Kohn L, Christiaens W, Detraux J, De Lepeleire J, De Hert M, Gillain B, et al. Barriers to somatic health care for persons with severe mental illness in Belgium: a qualitative study of patients' and healthcare professionals' perspectives. *Front Psychiatry*. 2022;12:798530.
58. Manyapelot T, Mokhele T, Sifunda S, Ndlovu P, Dukhi N, Sewpaul R, et al. Determinants of confidence in overall knowledge about COVID-19 among healthcare workers in South Africa: results from an online survey. *Front Public Health*. 2021;9:614858.
59. Kim MK, Arsenaault C, Atuyambe LM, Macwan'gi M, Kruk ME. Determinants of healthcare providers' confidence in their clinical skills to deliver quality obstetric and newborn care in Uganda and Zambia. *BMC Health Serv Res*. 2020;20:1–10.
60. Mossialos E, Courtin E, Naci H, Benrimoj S, Bouvy M, Farris K, et al. From retailers to health care providers: transforming the role of community pharmacists in chronic disease management. *Health Policy*. 2015;119(5):628–39.
61. Minh PD, Huong DT, Byrkit R, Murray M. Strengthening pharmacy practice in Vietnam: findings of a training intervention study. *Trop Med Int Health*. 2013;18(4):426–34.

62. Rao KD, Mehta A, Kautsar H, Kak M, Karem G, Misra M, et al. Improving quality of non-communicable disease services at primary care facilities in middle-income countries: a scoping review. *Soc Sci Med*. 2023;320:115679.
63. Hesselink G, Schoonhoven L, Barach P, Spijker A, Gademan P, Kalkman C, et al. Improving patient handovers from hospital to primary care: a systematic review. *Ann Intern Med*. 2012;157(6):417–28.
64. Phillips RL. Primary care in the United States: problems and possibilities. *BMJ*. 2005;331(7529):1400–2.
65. Eades CE, Ferguson JS, O'Carroll RE. Public health in community pharmacy: a systematic review of pharmacist and consumer views. *BMC Public Health*. 2014;11:582.
66. Saramunee K, Kraska J, Mackridge A, Richards J, Suttajit S, Phillips-Howard P. How to enhance public health service utilization in community pharmacy? General public and health providers' perspectives. *Res Social Adm Pharm*. 2014;10(2):272–84.
67. McCormick P, Coleman B, Bates I. The value of domiciliary medication reviews - a thematic analysis of pharmacist's views. *Int J Clin Pharm*. 2022;44(4):1004–12.
68. Ginsburg PB. Payment and the future of primary care. *Ann Intern Med*. 2003;138(3):233–4.
69. Zhu J. Study on the Influence of zero-profit drug policy on the economic operation and medical expenses of primary health care institutions: Master's thesis, Anhui Medical University, 2012:18–19 (in Chinese).
70. Yi H, Miller G, Zhang L, Li S, Rozelle S. Intended and unintended consequences of China's zero markup drug policy. *Health Aff (Millwood)*. 2015;34(8):1391–8.
71. Houle SK, Grindrod KA, Chatterley T, Tsuyuki RT. Paying pharmacists for patient care: a systematic review of remunerated pharmacy clinical care services. *Can Pharm J (Ott)*. 2014;147(4):209–32.
72. Bernsten C, Andersson K, Garipey Y, Simoens S. A comparative analysis of remuneration models for pharmaceutical professional services. *Health Policy*. 2010;95(1):1–9.
73. Hussain R, Babar Z-U-D. Global landscape of community pharmacy services remuneration: a narrative synthesis of the literature. *J Pharm Policy Pract*. 2023;16(1):118.
74. Porteous T, Ryan M, Bond C, Watson M, Watson V. Managing minor ailments; the public's preferences for attributes of community pharmacies. *A Discrete Choice Experiment*. *PLoS ONE*. 2016;11(3):e0152257.
75. Tsao NW, Khakban A, Gastonguay L, Li K, Lynd LD, Marra CA. Perceptions of British Columbia residents and their willingness to pay for medication management services provided by pharmacists. *Can Pharm J (Ott)*. 2015;148(5):263–73.
76. Törres LL, Azevedo PS, Rocha Sarmento TT, Ramalho-de-Oliveira D, Reis EA, Dias Godói IP, et al. Acceptability and consumers' willingness to pay for comprehensive medication management services in Brazil. *J Comp Eff Res*. 2024;13(4):e230127.
77. Vajapey SP, Weber KL, Samora JB. Confidence gap between men and women in medicine: a systematic review. *Curr Orthop Pract*. 2020;31(5):494–502.
78. Ferguson E, James D, Madeley L. Factors associated with success in medical school: systematic review of the literature. *BMJ*. 2002;324(7343):952–7.
79. O'Connor K, King R, Malone KM, Guerandel A. Clinical examiners, simulated patients, and student self-assessed empathy in medical students during a psychiatry objective structured clinical examination. *Acad Psychiatry*. 2014;38(4):451–7.
80. Pierides K, Duggan P, Chur-Hansen A, Gilson A. Medical student self-reported confidence in obstetrics and gynaecology: development of a core clinical competencies document. *BMC Med Educ*. 2013;13:62.
81. Snella KA, Sachdev GP. A primer for developing pharmacist-managed clinics in the outpatient setting. *Pharmacotherapy*. 2003;23(9):1153–66.

#### Publisher's Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.