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Assessing Readiness for Pharmacy Internships in Chinese Training Hospitals: Development and Validation of a Self-Assessment Instrument

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Abstract

Pharmacy internships within training hospital departments play a key role in the professional growth of pharmacy students. Yet, the standard of these internships differs greatly among Chinese hospitals, and there is a shortage of tools to systematically evaluate hospital readiness. This study aimed to design a self-assessment instrument to measure how prepared training hospitals are for hosting pharmacy internships. A two-phase exploratory mixed-methods approach was used. In the first phase (2021), focus groups were held with 16 interns from three tertiary hospitals in Henan Province. In 2022, 14 preceptors from tertiary hospitals in multiple provinces participated in individual interviews or focus groups. The data were analyzed thematically to generate potential indicators of internship readiness. These indicators, combined with a literature review, formed the first draft of a self-assessment tool. In the second phase, the Delphi method was employed in 2023. Experts were surveyed in two rounds (21 in round one, 19 in round two) to reach agreement on the final indicators, while also evaluating the current internship readiness of Chinese training hospitals.

Phase one produced five major themes and 22 sub-themes, which were combined with literature-based indicators to create an initial framework containing five domains and 37 items. In phase two, expert feedback achieved response rates of 90.48% and 89.47% for the two rounds. The finalized tool consisted of five dimensions and 35 secondary indicators: (1) organizational structure, (2) training content, (3) training mode, (4) effectiveness evaluation, and (5) emergency management. Expert assessment showed variation in hospital readiness, with emergency management scoring highest, followed by organizational structure and content, while training modes and effectiveness evaluation scored lower. The resulting self-assessment tool offers a comprehensive checklist for pharmacy departments in training hospitals and could support the improvement of internship training programs.

Keywords: Internship, Training hospital, Readiness, Mixed-method study

Introduction

Internships at training hospitals are essential for pharmacy students, bridging the gap between classroom learning and professional practice while helping them adapt to hospital pharmacy roles [1]. Training hospitals allow students to apply knowledge in practical settings, develop teamwork and communication skills, and gain insight into hospital workflows and patient care, which prepares them to deliver tailored pharmaceutical services [2]. The design of hospital internship programs—including scheduling, content, and training approaches—also influences their quality. Well-structured internships improve interns' skills and competence, highlighting the need to enhance hospital readiness and optimize internship experiences [3, 4].

Compared to the 60-year development of pharmacy education in the U.S., China's pharmacy internships began later, leaving gaps in system development and

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readiness evaluation. Since 1980, some training hospitals have introduced clinical pharmacy courses and standardized post-graduate training for pharmacy students. Recently, large tertiary hospitals have gradually established structured mentoring systems [5]. In Beijing, post-graduate clinical pharmacist training is divided into two stages: general pharmacist training, which focuses on six core competencies—prescription review, dispensing, medication counseling, adverse reaction reporting, pharmacy management, and drug quality management; and clinical pharmacist training, which emphasizes six skills—ward rounds, consultations, complex case discussions, information intelligence, patient education, and medication history recording. In 2005, the Ministry of Health piloted clinical pharmacist training projects with defined objectives, content, funding, duration, and management requirements, exploring models and policies for clinical pharmacist development [6, 7]. In 2018, the Ministry of Education outlined the creation of National Clinical Teaching and Training Demonstration Centers, detailing objectives, scope, and criteria for establishing training bases [8]. In 2023, the Chinese Hospital Association introduced regulations for clinical pharmacist teacher training bases, including a one-year intensive program for qualified pharmacists with clear training content and evaluation procedures [9].

Despite these advancements, Chinese pharmacy internships still face challenges: a lack of national guidelines, insufficient mentoring programs, limited tools to measure training effectiveness, and inconsistent training across hospitals [10]. Developing a self-assessment tool specific to pharmacy departments' readiness is therefore essential to improve internship quality.

Assessing the preparedness of pharmacy departments in training hospitals has been a major topic in international studies. In China, however, research focusing on self-evaluation of internship readiness is still limited and lacks depth. Important factors commonly used in readiness assessments include the qualifications of preceptors, availability of educational resources, practical relevance of internship programs, comprehensiveness of placement opportunities, robust assessment tools and feedback systems, and the cultivation of teamwork and collaboration [11]. Evaluating whether hospitals provide high-quality, holistic training—through methods such as surveys, interviews, observation, and direct communication with interns—is essential for improving interns' professional abilities and competence [12].

Zhao *et al*. [13] identified several tools for evaluating the internship experience of pharmacy students, including the *Postgraduate Hospital Educational Environment Measure (PHEEM)*, *Perceived Stress Scale (PSS)*, *General Health Questionnaire-12 or 30 (GHQ-12 or GHQ-30)*, *Patient Health Questionnaire-9 (PHQ-9)*, and the *Maslach Burnout Inventory (MBI)*. These instruments help monitor interns' well-being, highlight areas needing improvement, and provide guidance for self-assessment of hospital readiness. Despite these tools, research examining the quality and effectiveness of individual internship components remains scarce. In China, studies have explored hospital pharmacy mentoring models, challenges, and solutions, as well as preceptors' experiences, but comprehensive evaluations of internship quality and outcomes are still lacking [14–18]. There is also limited evidence on how internships influence interns' skills and professional growth.

As previously noted, gaps persist in China's pharmacy internship system. Earlier qualitative studies investigated the experiences and suggestions of both interns and preceptors. Interns highlighted negative aspects of the current system, pointing to insufficient clinical faculty skills, poorly structured internship modes, and unscientific training content [10]. Similarly, preceptors identified systemic weaknesses, such as the absence of a structured training plan, inconsistent standards for content and methods, inadequate evaluation of interns' clinical competence, and limited availability of validated assessment tools [19]. Drawing on these findings and recognizing the lack of self-assessment instruments, this study aimed to explore pharmacy departments in training hospitals and to create a self-assessment tool for evaluating internship readiness. This tool is intended to guide improvements in pharmacy internship programs within China and potentially provide insights internationally.

Materials and Methods

Ethical approval

The study protocol was approved by the Institutional Review Board of The First Affiliated Hospital of Zhengzhou University (2019-KY-304). Written informed consent was obtained from all participants.

Study design

An exploratory mixed-methods approach [20] was employed, conducted in two sequential phases. Phase one consisted of qualitative research, including in-depth interviews with interns and preceptors, which generated data to construct an initial set of self-assessment indicators. Phase two employed quantitative methods using the Delphi technique to validate the initial findings. The literature review was first conducted to identify potential indicators, which were then combined with interview-derived indices to produce a preliminary self-assessment draft. Following two rounds of Delphi consultation, the finalized self-assessment tool for evaluating pharmacy department internship readiness was developed. The study adhered to the *Good Reporting of a Mixed Methods Study* guidelines, and the overall research workflow is presented in **Figure 1**.

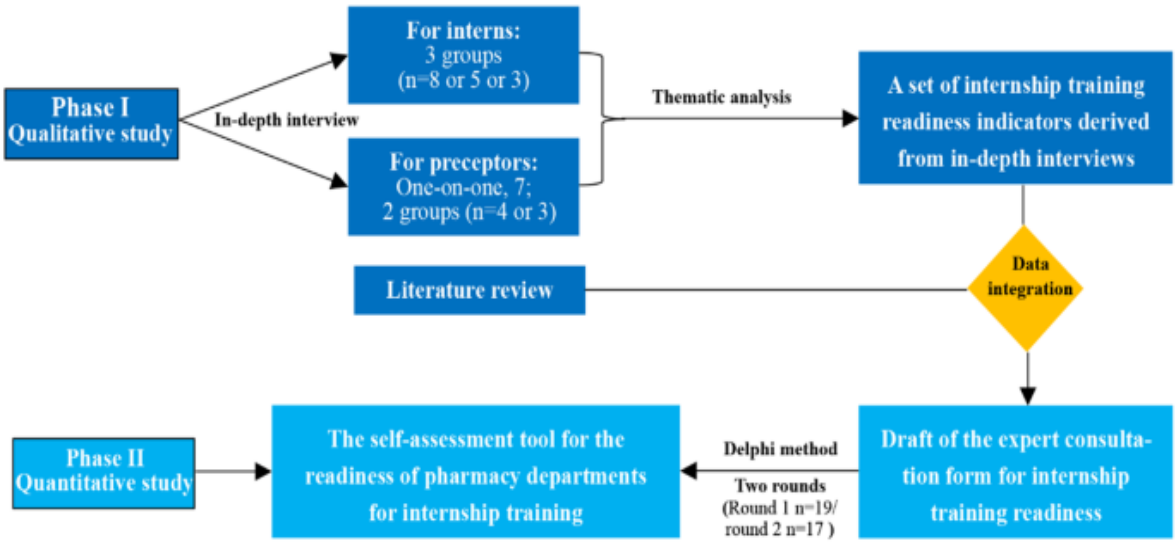

Figure 1. Research methodology

Phase I: qualitative study

Participants

Focus groups were conducted with interns from three top-tier hospitals in Henan Province (The First Affiliated Hospital of Zhengzhou University, The Third Affiliated Hospital of Zhengzhou University, and the People's Hospital of Henan Province) between February and June 2021. In-depth interviews with preceptors were held at three general hospitals across China (The First Affiliated Hospital of Zhengzhou University – Henan Province, Zhengzhou; The First Affiliated Hospital of Zhongshan University – Guangdong Province, Guangzhou; Sichuan Provincial People's Hospital – Sichuan Province, Chengdu) from January to March 2022. Interns and preceptors were recruited using purposeful and snowball sampling techniques.

Inclusion criteria

Interns: (1) Must have completed at least three years of study in a School of Pharmacy, as internships typically start in the third or fourth year; (2) Must have participated in hospital internships for at least three months to ensure adequate exposure.

Preceptors: (1) Pharmacists with intermediate or higher titles responsible for drug procurement, dispensing, prescription review, guiding rational drug use, clinical pharmacy tasks, and research or training duties; (2) Extensive work experience; (3) Prior experience mentoring interns.

Both groups: Willingness to participate in the study.

Data collection

Participants were contacted directly via phone, WeChat, and email. Before conducting the main interviews, two interns and two preceptors participated in preliminary sessions, which helped refine and expand the interview guide. A detailed version of the interview outline is provided in Box 1. Prior to each interview, participants were briefed on the study's purpose and background, and written informed consent was obtained from those willing to join. Interview schedules were arranged based on the convenience of each participant. The interviews were led by researcher ZY and recorded by XDJ; both

have extensive experience in training and have conducted multiple qualitative studies with other research groups. All sessions were fully audio-recorded. Data saturation was considered reached when no additional themes or codes emerged from the discussions [19]. **Table 1** summarizes the duration, number of rounds, and participant groupings for the interviews.

Table 1. Interview groups and durations for interns and preceptors

Category		Value
Duration of each interview		32 (20–58) minutes
One-on-one interview – The First Affiliated Hospital of Zhengzhou University		45 minutes
Number of intern participants		8
Interns – Group 1: The First Affiliated Hospital of Zhengzhou University		5
Interns – Group 2: The Third Affiliated Hospital of Zhengzhou University		3
Interns – Group 3: The People's Hospital of Henan Province		4
Number of preceptor participants		3
Preceptors – Group 1: The First Affiliated Hospital of Sun Yat-sen University		7
Preceptors – Group 2: Sichuan Provincial People's Hospital		2 hours and 45 minutes
Additional recorded sessions		56 minutes 1 hour and 11 minutes 1 hour and 1 minute
Participant Group	**Question Number**	**Question**
For interns	1	From your viewpoint, how should pharmacy departments in healthcare institutions prepare for internship training programs?
	2	Drawing from your personal internship experience, do you consider the current training content, teaching approaches, and assessment methods to be appropriate? What recommendations would you offer?
	3	Please describe the most memorable experience you encountered during your internship.
For preceptors	1	From your perspective, how should pharmacy departments in medical institutions prepare for internship training?
	2	What topics do you typically include when training interns? In your view, which areas require improvement?
	3	Do you believe the current teaching methods for internships are appropriate? What suggestions do you have?
	4	How do you assess interns? What recommendations do you have for improving intern evaluation?
	5	How do you rate the current preparedness of the training hospital for practical teaching? What improvements would you suggest?
	6	Please share both positive and negative experiences you have encountered during the teaching process.

Data analysis

Thematic analysis was used to process the interview transcripts, a method widely adopted in qualitative research for identifying, analyzing, and reporting patterns. The analysis followed these steps: familiarization with the transcripts, generation of initial codes, identification and review of potential themes, naming of themes, and production of the final report. Transcripts were completed within 24 hours of recording, and NVivo12 was used to organize and manage the data. Researchers validated the transcriptions with participants to ensure accurate representation of their views. Two researchers independently coded the data and drafted the initial themes and sub-themes. The research team then collaboratively reviewed these drafts, offering feedback on organization, language, and clarity. Final themes and sub-themes were agreed upon through group consensus, and illustrative quotations were selected to represent each category. The qualitative report adhered to the *Consolidated Criteria for Reporting Qualitative Research* (COREQ) checklist.

Phase II: quantitative study

Expert panel formation

Selecting qualified experts is critical for the Delphi process, as the panel's composition affects the reliability and validity of results [21, 22]. Recommended panel sizes typically range from 15 to 50 experts [23]. For this study, experts were included if they met the following criteria: (1) affiliation with a highly ranked and reputable training hospital in China, (2) more than five years of experience in hospital pharmacy, (3) involvement in teaching or managing internship programs, and (4) willingness to participate in multiple Delphi rounds. Using these criteria, 21 experts were selected, representing hospitals from Central China (The First Affiliated Hospital of Zhengzhou University, Henan Provincial People's Hospital, Henan Provincial Cancer Hospital), South China (The First Affiliated Hospital of Sun Yat-Sen University), and West China (Sichuan Provincial People's Hospital).

Research tools

A comprehensive literature search was conducted using CNKI, Wanfang Data, VIP Database, SinoMed, PubMed, Web of Science, Cochrane Library, and EMBASE, covering all publications until April 2023. Keywords included "pharmacy interns," "hospital pharmacy," "internship training," "training mode," and "internship evaluation." Based on the qualitative findings and literature review, the research team drafted the initial Delphi questionnaire. Prior to administering it, cognitive interviews were conducted with two experienced pharmacy preceptors. During these sessions, preceptors read each item aloud, explained their interpretation, and indicated the most appropriate options, providing valuable feedback to refine the questionnaire [24].

The first-round Delphi questionnaire included 5 domains and 37 items, organized into three sections. Section one collected demographic details of the experts, including age, work experience, educational background, and professional title. Section two asked experts to rate the importance of each self-assessment indicator on a five-point Likert scale (1 = not important at all, 5 = very important), with space for recommendations. Section three provided a table for experts to indicate their familiarity with the survey content and justify their scoring decisions [25].

Data Collection

The study implemented two rounds of expert consultation strictly following the Delphi technique. Between June and August 2023, surveys were administered through the online platform *Questionnaire Star* (Changsha Ranxing Information Technology Co., Ltd.), a commonly used free tool in China. Experts were first briefed on the study objectives and background, and informed consent was obtained. They then rated the proposed indicators and suggested revisions.

Data analysis

Responses from the first round were compiled and summarized to create the second-round questionnaire. Indicators with a mean score below 4.0 or a coefficient of variation greater than 0.25 were proposed for removal, and experts were asked to confirm or reconsider these deletions. In addition, the panel evaluated the current status of internship training in Chinese hospitals [26]. Copies of the questionnaires are included in Appendices 3 and 4.

Data were processed using Excel and SPSS. For each indicator, the arithmetic mean, standard deviation, and coefficient of variation were calculated to reflect importance. Expert engagement was represented by the questionnaire response rate, while the authority coefficient (Cr) was computed as the average of the expert's familiarity with the indicators (Cs) and their basis for judgment (Ca) [27]. Consensus was assessed via the coefficient of variation and Kendall's coordination coefficient (values range from 0 to 1; values closer to 1 indicate higher agreement). Spearman correlation analysis examined the relationship between the experts'

average importance ratings and their evaluations of internship training readiness.

Results and Discussion

Demographic characteristics

During the first qualitative phase, 16 interns and 14 preceptors participated. Interns had a mean age of 21 years and had completed internships exceeding six months in duration **(Table 2)**. Preceptors averaged 36.1 years of age, with a mean service duration of 11.3 years **(Table 3)**.

Table 2. Demographic characteristics of 16 interns

Characteristic	Value
Gender	
Male	1 (6.25%)
Female	15 (93.75%)
Age, years	
Mean (range)	21 (20–24)
Median (SD)	21 (1.05)
Major	Pharmacy
Number of departments rotated	
Mean (range)	3 (1–6)
Internship duration, months	
Mean (range)	7.38 (6–8)
Distribution of interns across training hospitals	
The First Affiliated Hospital of Zhengzhou University	8 (50.00%)
The Third Affiliated Hospital of Zhengzhou University	5 (31.25%)
The People's Hospital of Henan Province	3 (18.75%)

Table 3. Demographic characteristics of 14 preceptors

Characteristic	Value
Gender	
Male	6 (42.86%)
Female	8 (57.14%)
Age, years	
Mean (range)	36.1 (27–52)
Working years	
Mean (range)	11.3 (4–30)
Professional title	
Intermediate level	9 (52.63%)
Associate advanced level	7 (42.11%)
Advanced level	1 (5.26%)
Number of interns trained	
1–4	3 (21.43%)
5–10	8 (57.14%)
> 10	3 (21.43%)
Distribution of preceptors across training hospitals	
The First Affiliated Hospital of Sun Yat-sen University	4 (28.57%)
Sichuan Provincial People's Hospital	3 (21.43%)

The First Affiliated Hospital of Zhengzhou University	7 (50.00%)

In the initial round of Delphi consultation, 19 of 21 invited experts responded. The second round saw 17 of 19 experts participate. Sociodemographic information of the expert panel for both rounds is presented in **Table 4**.

Table 4. Demographic characteristics of experts participating in two Delphi rounds

Characteristic	Delphi Round 2 n (%)	Delphi Round 1 n (%)
Number of experts	17	19
Gender		
Male	7 (41.18%)	8 (42.11%)
Female	10 (58.82%)	11 (57.89%)
Age, years		
Mean (SD)	37.94 (5.97)	37.74 (5.97)
< 40	12 (70.59%)	13 (68.42%)
40–50	4 (23.53%)	5 (26.32%)
> 50	1 (5.88%)	1 (5.26%)
Work experience in pharmacy, years		
Mean (SD)	12.24 (7.22)	12.11 (6.94)
4–9	9 (52.94%)	10 (52.63%)
10–19	6 (35.30%)	7 (36.85%)
20–29	1 (5.88%)	1 (5.26%)
30–39	1 (5.88%)	1 (5.26%)
Professional title		
Intermediate level	9 (52.94%)	10 (52.63%)
Associate advanced level	7 (41.18%)	8 (42.11%)
Advanced level	1 (5.88%)	1 (5.26%)

Qualitative results

Analysis of the first phase of qualitative research yielded 5 domains encompassing 22 items **(Figure 2)**. These domains included organizational structure for internships, training content, training methods, evaluation of training effectiveness, and emergency management for internships. **Table 5** presents the identified themes, sub-themes, and illustrative quotations.

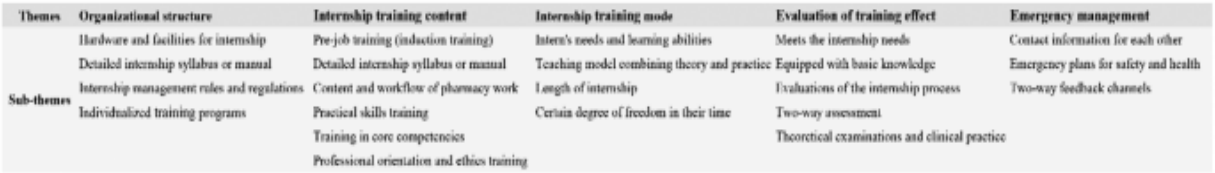

Figure 2. Themes and sub-themes from the first qualitative phase

Table 5. Themes, sub-themes, and example quotations

Dimension	Item	Representative Quotations
Organizational Structure	Hardware and facilities for internship	(G5P3) There are too many students, and the lab space is limited, so it's impossible for everyone to access specialized equipment freely… (G5P2) The mass spectrometer area is overcrowded; I couldn't even enter the room, and when another student came, there was no space for us to sit…

	Detailed internship syllabus or manual	(G1P1) Different specialties require mastery of specific theoretical knowledge and clinical skills, so we prepare a basic syllabus for instruction.
	Internship management rules and regulations	(G2P1) It includes organizational management training, such as work hours, supervision, and leave policies. There's also instruction on day-to-day responsibilities and absence management, which is very important.
	Individualized teaching programs	(P5) Teaching should be tailored to the intern's role and background, as undergraduates and specialists have different foundational knowledge and learning requirements.
Internship Training Content	Pre-job training (induction)	(G2P2) When students arrive, I provide a 30–60 minute induction session covering hospital basics and the structure of the pharmacy department, which often has over ten sub-departments.
	Detailed internship syllabus or manual	(P7) I prepare a weekly plan specifying what will be covered each week so that interns clearly know the progression of the internship.
	Content and workflow of pharmacy work	(G2P2) For example, in emergency medicine, interns should receive at least two practical sessions per month. Training covers workflows, systems, and specific job responsibilities.
	Practical skills training	(P5) In the outpatient department, interns explain medicine precautions to patients… (P4) …also provide patient education on medication use.
	Training in core competencies	(G1P1) Developing skills in literature review, organization, and summarization is essential… (G1P3) …communication skills are equally important as professional knowledge… (G5P2) …also enhances self-learning abilities.
	Professional orientation and ethics training	(P5) Instructors hope interns gain initial understanding of career directions, such as patient interaction roles… (G4P2) …helps students explore suitable career paths post-graduation.
Internship Training Mode	Intern's needs and learning abilities	(G1P4) The training model should align with interns' specific needs. (G5P3) After choosing a focus area, instructors adjust the training according to departmental requirements and individual circumstances.
	Teaching model combining theory and practice	(G1P3) The training is practice-oriented, emphasizing real-world experience alongside theoretical knowledge.
	Length of internship	(P3) The duration of the internship affects learning; shorter rotations prevent full comprehension despite intensive instruction.
	Certain degree of time flexibility	(P7) Students appreciate flexible scheduling to adjust to learning pace and personal adaptation… (G4P3) …having some control over study time reduces stress and enhances focus.
Evaluation of Training Effect	Meets the internship needs	(P7) Students are shown research directions and then matched with projects aligning with their interests and future study plans.
	Equipped with basic knowledge	(P1) Some students lack fundamental knowledge like first-, second-, and third-generation cephalosporins… (G3P2) Interns often feel their foundational knowledge is insufficient.
	Evaluations of the internship process	(G1P3) Process assessments occur daily, including medication guidance and pharmacy consultation, not just through final exams.
	Two-way assessment	(G2P1) Two-way assessment involves feedback from students on instructors and departments, and vice versa, covering all levels of the internship experience.
	Theoretical examinations and clinical practice	(G1P1) Interns take dedicated exams to test theoretical and practical skills… (G1P2) Clinical pharmacists are assessed on both theory and skills.
Emergency Management	Contact information for each other	(G1P1) It is crucial to have accessible contact info for interns, counselors, and group leaders; otherwise, locating students can be stressful.
	Emergency plans for safety and health	(G1P1) If a student is absent without notice, it can be alarming; tracking them is essential. (P3) All leave requests and safety responsibilities are strictly managed.

	Two-way feedback channels	(G2P3) Interns are instructed to report issues to departmental leaders or come directly to instructors if unresolved. (P2) Prompt communication is essential to address problems effectively and understand interns' interests.

Note: Codes G1P1-G2P3, P1-P7 denote preceptors; G3P1-G5P5 denote interns

Quantitative results

The calculated authority coefficient for experts was 0.779, close to 0.80, indicating high credibility. Kendall's coordination coefficients were 0.216 (primary indicators, $P < 0.001$) and 0.172 (secondary indicators, $P < 0.001$), demonstrating good agreement among experts.

Combining qualitative findings with the literature review, the research team developed an initial Delphi questionnaire consisting of 5 domains and 37 items.

Delphi method – round 1

In the first round of consultation, four experts recommended changes. One suggested removing the indicator "3.4 Whether interns have some freedom of time." The remaining three proposed adjustments to the wording of four indicators. The Level 1 indicator "the degree of preparation of content for training internships" was revised to "training content readiness of internship." The Level 2 indicator "2.1 Whether interns are provided with training in vocational orientation and professional ethics in order to enhance interns' awareness of the specialty and their future career planning" was simplified to "Whether interns are provided with vocational orientation and professional ethics training." Another indicator, "2.2 Whether to provide interns with career orientation and professional ethics training to enhance their awareness of the specialty and their future career planning," was reworded as "The content of pre-service training is well developed, including introductions to relevant pharmacy regulations, departmental rules for interns, and an overview of the department's organization and functions." Similarly, "4.5 Whether there is a dynamic assessment of the internship process" was changed to "Whether there is a regular or periodic evaluation of the internship process."

One expert pointed out that several secondary indicators combined multiple questions into a single item, which conflicted with standard design principles. After the panel discussion, "2.10 Whether there is a training internship for clinical pharmacists specializing in prescription review, formulation of pharmacy monitoring plan, clinical medication guidance, rational medication evaluation, etc." was revised to "2.10 Whether there are training internships of specialized skills for clinical pharmacists." Indicator 2.11, initially "Whether interns are trained in core competencies such as communication skills, clinical thinking skills, research thinking skills, independent learning skills, critical thinking, etc.," was simplified to "2.11 Whether interns are trained in the core competencies of pharmacists."

Experts rated the importance of each indicator. Mean scores, standard deviations, and coefficients of variation were calculated. The primary indicator "preparedness for emergency management of internship training" and five secondary indicators (1.7; 3.4; 4.1; 4.2; 4.4) had mean scores below 4.0 and coefficients of variation above 0.25. Therefore, experts were consulted again regarding whether these items should be removed.

Delphi method – round 2

During the second round, consensus was reached on most items. Experts agreed with the wording changes from Round 1 for the Level 1 indicator "training content readiness of internship" and Level 2 indicators 2.2, 2.10, 2.11, and 4.5. However, the suggested change for 2.1 was rejected. Items 1.7 and 3.4 were approved for removal. The primary indicator on emergency management and secondary indicators 4.1, 4.2, and 4.4 were retained.

After two rounds of consultation, a self-assessment tool for evaluating pharmacy department internship readiness was finalized. It includes five primary indicators and 35 secondary indicators **(Table 6)**.

Table 6. Index system for self-evaluation of internship training

Domains and Items	Importance Rating of Indicators	Ratings for Readiness in Training Hospitals
	Mean	SD
1. Organizational Structure Readiness for Internships	4.632	0.684
1.1 Availability of comprehensive internship management rules and regulations	4.684	0.671

1.2 Presence of relevant hardware and facilities suitable for internship training	4.526	0.612
1.3 Existence of an internship leadership or supervisory team	4.421	0.692
1.4 Availability of a structured selection program for preceptors	4.105	0.809
1.5 Existence of formal job descriptions for internship preceptors	4.158	0.688
1.6 Availability of a detailed internship syllabus or handbook	4.632	0.597
1.7 Availability of individualized programs tailored to interns' needs *a*	3.737	0.933
1.8 Whether preceptors receive regular training in relevant pharmacy services and teaching	4.368	0.761
2. Internship Training Content Readiness *b*	4.789	0.419
2.1 Provision of vocational orientation and professional ethics training for interns *b*	4.526	0.772
2.2 Well-structured pre-service training including hospital regulations, intern management, and departmental functions *b*	4.474	0.841
2.3 Detailed internship schedule and training plan	4.474	0.612
2.4 Training in hospital pharmacy workflows and job responsibilities	4.526	0.772
2.5 Training in medication dispensing, management, and practical skills	4.421	0.838
2.6 Training in medication counseling and instruction skills	4.263	0.806
2.7 Learning to operate pharmacy information technology systems	4.263	0.933
2.8 Training in PIVAS operations	4.053	0.970
2.9 Training on adverse drug reaction management and reporting	4.053	0.970
2.10 Specialized skill training for clinical pharmacists *b*	4.368	0.955
2.11 Training in core pharmacist competencies *b*	4.316	0.671
2.12 Demonstration of humanistic care by internship instructors	4.526	0.697
3. Internship Model Readiness	4.368	0.761
3.1 Use of diversified internship training approaches	4.316	0.671
3.2 Training content arranged according to internship duration	4.421	0.692
3.3 Training content tailored to interns' practical needs and learning abilities	4.053	0.970
3.4 Providing interns with flexible scheduling options *a*	3.421	1.071
3.5 Combination of theoretical and practical training models	4.579	0.507
4. Readiness to Evaluate Internship Effectiveness	4.263	0.806
4.1 Intern consultation on individual internship needs	3.684	1.057
4.2 Evaluation of the training environment for interns' needs	3.526	0.905
4.3 Assessment of whether internship content meets objectives	4.000	0.816
4.4 Evaluation of interns' foundational knowledge before placement	3.842	1.119
4.5 Regular or periodic evaluation of internship progress *b*	4.158	0.765
4.6 Intern assessment including theoretical and clinical evaluations	4.474	0.513
4.7 Evaluation of supervisor performance by internship oversight team	4.158	0.765
4.8 Intern assessment of preceptor guidance effectiveness	4.368	0.761
5. Emergency Management Preparedness for Internship Leaders	3.947	1.079
5.1 Availability of contact information for interns and preceptors	4.368	0.684
5.2 Two-way feedback channels for issues during training	4.579	0.607
5.3 Presence of emergency plans for personal and health safety	4.579	0.692
5.4 Training interns on occupational safety and self-protection	4.526	0.697

Notes: a = included in Round 1 but removed after Round 2; b = included in Round 1 but revised in the final version after Round 2; SD = standard deviation; CV = coefficient of variation

In Round 2, experts also rated the current internship readiness in China for each indicator on a 0–100 scale. Scores ranged from 61.118 ± 21.523 (for whether interns possessed adequate basic knowledge before starting the department) to 93.529 ± 10.572 (for whether contact information for interns and preceptors was established). Emergency management preparedness scored highest (average 89.118), followed by organizational structure (average 81.25) and training content (average 81.226). Lower scores were observed for internship training methods (average 77.412) and evaluation of training effectiveness (average 71.03).

Figure 3 illustrates the relationship between expert-rated indicator importance and current training readiness in hospitals ($r = 0.722$, $p < 0.0001$).

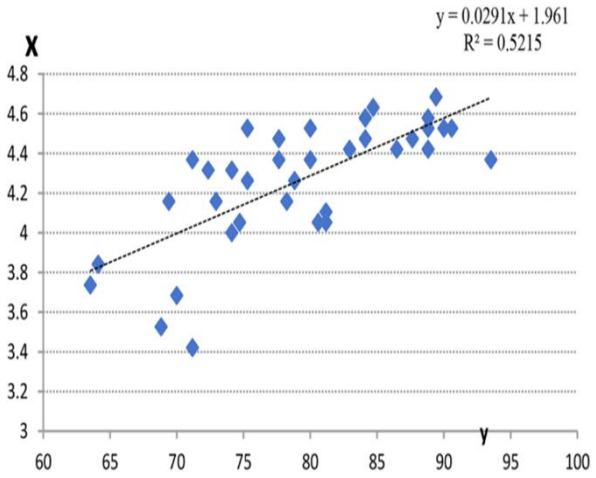

Figure 3. Expert ratings of indicator importance versus current hospital internship readiness. X-axis: mean importance rating per indicator; Y-axis: mean rating of training readiness

To our knowledge, this study is the first in mainland China to apply a mixed-methods design—combining qualitative and quantitative approaches—to develop a readiness assessment for pharmacy internships in training hospitals. The findings suggest that pharmacy departments should ensure comprehensive preparation across organizational structure, training content, training methods, evaluation processes, and emergency management. Experts' assessments of readiness varied across these areas, highlighting specific domains where training hospitals require improvement.

The organizational structure of internship programs encompasses the hospital's infrastructure, training-related systems, and the selection and development of preceptors. Assessments revealed particularly low scores for "Availability of job descriptions for preceptors" and "Whether preceptors receive regular training in relevant pharmacy and training topics." Chinese pharmacy graduates face difficulties due to the absence of structured clinical rotation programs, legal frameworks, standardized guidelines, qualified preceptors, and accredited internship sites [28]. In contrast, Japan [29] has established government-accredited internship standards, including basic infrastructure requirements, preceptor qualification criteria, and standardized training and assessment programs. Similarly, in Korea [30–32], universities and hospital pharmacies collaborate to enhance training and assessment models, with hospital pharmacy departments overseeing internships and schools providing supporting resources to facilitate joint development.

Some large Chinese training hospitals and pharmacy chains have established internship bases in partnership with universities, accommodating many pharmacy students from higher vocational colleges and universities. However, there is no national certification standard for these bases, and detailed requirements regarding facilities and preceptor qualifications are lacking, limiting the effectiveness of internships [33]. Future initiatives should focus on improving preceptors' role awareness, enhancing their skills, establishing clear access systems, implementing effective training evaluation methods, and providing comprehensive institutional support [34].

Internship training content includes career orientation and professional ethics, pre-service training, training in dispensing departments, and clinical practice. Interns rated career orientation, ethics training, development of core pharmacist competencies, and pharmaceutical information technology training relatively low, indicating areas needing improvement. As a pivotal period in career decision-making, graduation internships allow students to understand work content and employment conditions, helping them make informed decisions about careers and further studies [35]. Internships also prepare students for future clinical responsibilities [36]. Core competencies for hospital pharmacists include the knowledge, skills, judgment, and personal qualities needed to deliver safe, effective, cost-efficient, and ethical patient-centered care. These competencies cover professional practice, communication and coordination, management, professional development, and critical thinking [37–39]. The study demonstrates that current internships do not

sufficiently equip interns with these core competencies. Strengthening core competency training can enhance pharmacy services, promote rational drug use, and improve patient safety [40].

Regarding internship training methods, diversified approaches combining theory and practice, as well as content tailored to the length of the internship and the interns' levels, are recommended. However, scores were low for methods incorporating variety and tailoring content to interns' abilities. Traditional internship approaches are often preceptor-led, with interns passively receiving instruction, reducing their motivation and initiative [41]. Innovative methods such as Problem-Based Learning (PBL) [42] and Case-Based Learning (CBL) [43] can increase engagement and effectiveness [44]. Diversified methods stimulate independent learning, research skills, and clinical competence while improving communication abilities. The study also identified a lack of personalized training content that accounts for students' prior knowledge, career goals, and interests. Given the diversity of interns' capabilities in China, preceptors should adapt training content to meet individual needs and learning capacities.

Effectiveness assessment of internship training

The present study indicates that evaluating pharmacy internship effectiveness requires a multi-dimensional approach, incorporating admission assessment, process evaluation, outcome evaluation, and bidirectional feedback. Despite this, overall ratings for internship training in China remain low, highlighting gaps compared with systems in developed countries:

1. *Admission assessment limitations:* China's pharmacy internship system started relatively recently, leading to hospitals accepting students with varying levels of prior education, such as undergraduates and master's students, without consistent admission standards. In contrast, Japan mandates that students pass the Pharmacy Common Achievement Test (CBT: Computer-Based Testing) and OSCE (Objective Structured Clinical Examination) before entering internships, preventing unlicensed students from participating [29, 45]. In the United States, a pharmacist must earn a Doctor of Pharmacy degree, pass the national licensure exam, and complete 1–2 years of residency before becoming a clinical pharmacist [46].
2. *Gaps in process and outcome evaluation:* Chinese pharmacy graduates frequently display limited practical skills due to an incomplete practical training framework. Most domestic hospitals still rely on conventional written and practical exams and lack comprehensive systems for evaluating internship outcomes [15]. By contrast, international programs involve multiple practical courses throughout professional training, assessed through attendance, online testing, participation in discussions, and mentor and peer evaluations, with each component weighted in the final assessment [47].
3. *Importance of bidirectional assessment:* Effective internship evaluation should consider both intern and preceptor performance. Preceptor evaluations are informed by intern feedback and input from the training team, providing insight into the preceptor's approach, instructional content, and effectiveness. This study emphasizes the urgent need to establish systematic evaluation methods for pharmacy internships in China.

Strengths and limitations

This study has several notable strengths. First, the indicators in the self-assessment tool are largely derived from the lived experiences of interns and preceptors and were refined through Delphi expert consensus, enhancing the tool's practicality and usability. Second, the experts involved were from top-tier tertiary hospitals in Central, Southern, and Southwestern China, improving the representativeness and credibility of the findings.

However, limitations exist. The self-assessment tool is dynamic, reflecting ongoing changes in hospital pharmacy and national healthcare reforms; continuous refinement of indicators is necessary to maintain relevance and specificity. Moreover, this study has not yet conducted large-scale empirical validation. Future research should involve nationwide studies to assess the tool's reliability, feasibility, and practical value, enabling further refinement of the indicator system.

Conclusion

The self-assessment tool developed in this study provides a structured framework for pharmacy departments in

training hospitals to evaluate internship readiness. Based on our findings, the following recommendations are proposed:

- *Organizational structure:* Strengthen hospital infrastructure, establish formal internship systems, and implement structured preceptor selection and training programs.
- *Internship content:* Include pre-job orientation, practical training in dispensing departments, and clinical department rotations.
- *Training methods:* Utilize diverse teaching methods to optimize learning outcomes.
- *Effectiveness evaluation:* Implement standardized assessment covering admission, process, outcomes, and bidirectional feedback.
- *Emergency management:* Develop comprehensive emergency management plans and bidirectional communication channels.

Government authorities should establish a national pharmacy internship syllabus, standardized training procedures, criteria for selecting training bases, and an authoritative evaluation system.

Considering study limitations, further research is planned. The next phase involves selecting multiple hospitals across central, eastern, western, northern, and southern China to conduct large-scale empirical studies, validating the tool's reliability and feasibility and supporting its broader implementation.

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