Survey on satisfaction and needs of pharmacists in prescription-checking training: a cross-sectional study

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Research article

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Abstract

Background Prescription-checking is becoming increasingly popular in medical institutions, but the prescription-checking ability of pharmacists needs improvement. This study aimed to explore the key aspects of the prescription-checking training and provide an empirical reference for standardizing the prescription-checking training for pharmacists in medical institutions.

Methods Trainees who were willing to complete the Likert questionnaire were enrolled in this study. Percentage and composition ratio were used for statistical description. The chi-square test and exploratory factor analysis were used for statistical analysis. A difference with $p<0.05$ was considered statistically significant.

Results The questionnaire had good internal consistency and validity. The overall satisfaction of the trainees was 90%. Three dimensions, training organization, teaching mode as well as consolidation and assessment of knowledge were extracted using exploratory factor analysis. The average examination score of the 20 courses was 89.21±2.62 points. From the perspective of needs, 94.66% of the trainees preferred face-to-face lectures, 89.33% of the trainees expected high professional skills of the lecturers, and 62.27% of the trainees believed that clinical expertise was highly desirable.

Conclusion There was a great demand for prescription-checking training among pharmacists. Trainees enrolled in this training showed high satisfaction and good examination results. The key aspects of prescription-checking training were training organization, as well as consolidation and assessment of knowledge. It is recommended to conduct training in a stratified manner according to pharmacists' educational background, in order to effectively improve their prescription-checking competence. The pharmacists preferred face-to-face lectures and interaction to supplement clinical disease-related knowledge.

Background

Prescription errors are common in clinics, which poses great risks to disease treatment. About 29.3% of drug-related events were reported to cause serious harm to patients and even death, between January 2005 and June 2006 [1]. In addition, there was a risk to patients who received medication in hospitals [2]. About 6% of inpatients experienced adverse drug events [3]. Corina Glanzmann et al. showed that 14% of prescriptions had errors (50% were dose errors) in a pediatric intensive care unit [4], most of which were avoidable medication errors. Prospective prescription-checking by pharmacists can ensure the safety and rationality of medication [5–7], and reduce irrational drug treatment, drug waste [8, 9], and the number of emergency department visits and hospital readmissions [10]. In the "new medical reform" environment, prescription-checking is also an important development direction for the transformation of pharmacists' function. Recently, three national departments jointly issued and implemented the Regulation for Prescription-checking for Medical Institutions (No. 14 [2018] of the Ministry of Health), which clarifies that pharmacists are the first responsible persons for prescription-checking. Hence, the role of advising and checking for medication becomes increasingly important [4, 11–13], which also places greater need of comprehensive quality on pharmacists. Prescription-checking requires optimal clinical knowledge, pharmacy knowledge, and work experience. However, pharmacists in medical institutions receive chemistry-based pharmacy-centered education [14], which is not closely related to their work [15]. Pharmacists in China must complete continuing education [16], but the traditional continuing education is not very helpful, which is similar to the situation in Lebanon [17]. In addition, practical experience is based on supplying medicine, which lacks knowledge and experience of medication, such as medicine review, pharmaceutical monitoring and rational drug use [18]. The prescriptions of doctors in medical institutions involve all departments of the hospitals, while the clinical knowledge of pharmacists is far below the requirements of checking prescriptions of different departments. Hence, prescription-checking is a big challenge for pharmacists in medical institutions. Pharmacists must continue to study and improve their skills and knowledge in order to adapt to development and changes of the pharmacy [12, 19]. Therefore, medical institutions should urgently conduct prescription-checking training with high frequency and intensity, in order to supplement relevant knowledge, strengthen professional knowledge, increase clinical medication experience and improve the comprehensive skills and prescription-checking competence of pharmacists. In order to effectively improve the prescription-checking ability of pharmacists and the rational use of drugs in hospitals in our province, the Shanxi Pharmaceutical Specialist Alliance organized the phase 1 class for prescription-checking training of pharmacists in medical institutions, which ended in May 2019.

Given that the pre-requisite prescription-checking is still in an exploratory stage in medical institutions of our country [20], and the standardized training for pharmacists is in a nascent stage [21], the training can only refer to the training experience of individual hospitals that have already conducted training and past training experience of pharmacists. In response to the relevant issues of this training in our province, the training satisfaction and requirements were surveyed using Likert scale, in order to explore the needs of prescription-checking training for pharmacists from different classes of medical institutions, of different ages and positions, aimed at providing a reference for the follow-up standardized prescription-checking training, building a team of prescription-checking pharmacists, improving the prescription-checking ability, and promoting clinical rational drug use.

1. Methods

The training was divided into theoretical study, practice and assessment. The theoretical study involved 20 courses, which were completed within 33 hours on four rest days. The practice was completed on working days during the training. The trainees reviewed and commented on the prescriptions of their institutions based on what they had learned to consolidate the knowledge. The assessment was an online open test. The test had a total score of 100, and questions were single-choice or multiple-choice. Each course was tested online on the same working day after the face-to-face lectures. The test link was opened at 18:00 on the working day, and closed at 18:00 on the next day, and the answer query link was opened at the time when the test link was closed for one day to provide learning. In Shanxi Province, a total of 826 pharmacists from different medical institutions were registered for prescription-checking training, of which 150 (18.16%) participated in the phase 1 training. From June 9–20, 2019, the questionnaire link was issued to the trainees in the WeChat group through the Sojump platform. Trainees could fill the questionnaire on their mobile phones. A total of 150 questionnaires were returned, all of which were valid after excluding those with unanswered items and with the same answer throughout the whole questionnaire. The effective recovery rate was 100%.

The questionnaire consisted of three parts: The first part introduced the background and objective of the survey. The second part involved the demographic information of participants, including gender, age, work experience, educational background, title, level and position in the medical institutions. The third part was the survey on the satisfaction for the training, needs of pharmacists and teaching effect. The questionnaire included a total of 23 items. Among them, 19 items were scored on the Likert scale, in which forward problems were set, scored in the order of 1–5 points, where the higher the score, the stronger the positive tendency of the measured content and the higher the satisfaction or demand. The other four items were open-ended questions. The trainees filled in the course duration, content and requirement for improvement based on their own situation. In terms of teaching effect evaluation, the trainees evaluated their own competency of prescription-checking, where 100 points referred to fully qualified, and 60 points referred to qualified.

In addition to the above scales, we also collected the score of each course of trainees, which reflected the mastery of the corresponding course.

The survey data were exported from the Sojump platform, and analyzed using SPSS22.0 (SPSS Inc., Chicago, IL, USA). Quantitative data were expressed as ±, of which those in line with non-normal distribution were described using median (quartile) and analyzed using non-parametric test. Qualitative data were described using percentage and composition ratio, and analyzed using chi-square test. Exploratory factor analysis was used to analyze latent variables in the satisfaction items. $a = 0.05$ was considered level of significance. A difference with $p<0.05$ was considered statistically significant.

This work has been carried out in accordance with the Declaration of Helsinki (2000) of the World Medical Association. This study was approved by the Ethics Committee of the Second Hospital of Shanxi Medical University (Number 2018KS008), verbal consent was obtained from study participants, The Ethics Committee of the Second Hospital of Shanxi Medical University considers that informed consent signature can be exempted. The questionnaire begins Includes a description of the study. The participants were informed that the participation was voluntary and responding to the survey implied an informed consent. This was an observational study that respected the confidentiality and autonomy of participants.

2. Results

2.1 Basic information of trainees

The trainees were aged 36.91±6.74 years. Their basic information such as gender, work experience, educational background and titles are listed in Table 1.

2.2 Reliability and validity test

Consistency reliability is considered reliable when Cronbach-*α* coefficient is >0.7[22]. In the present study, the coefficient of the scale was >0.8, indicating good internal consistency reliability (Table 2). The Cronbach-*α* coefficient was not calculated for the teaching effect since it only contained one item.

Questionnaires were reviewed by several pharmacy experts such as pharmacy education experts and directors of pharmacy department of grade-3 hospitals in Shanxi Province. Of these, eight experts were asked to score each item and evaluate the relevance of the item to its dimension. There were four levels for each item, from weaker to stronger correlation. The ratio of items scored 3 or 4 points by all experts to the total number of items (S-CVI) reflected the content validity of the scale. In the present study, the S-CVI of the scale was 0.91, which could be considered good content validity. The structural validity of the questionnaire was measured using KMO and Bartlett sphere test values. Statistical analyses showed that the KMO was 905, which was >0.8, and the chi-square value by Bartlett sphere test was 10169.46 ($p<0.001$), which indicated good validity, and prompted the feasibility of factor analysis.

2.3 Satisfaction analysis

2.3.1 Overall satisfaction From the personal satisfaction data of the respondents, 135 trainees had a satisfaction score of ≥4 points, accounting for 90%, 13 trainees indicated dissatisfaction (<3 points), accounting for 8.7%, and two trainees shared basic satisfaction (3 points), accounting for 1.3 %. The mean score was 4.51, which was higher than the theoretical score of satisfaction (4 points), and indicated that trainees were satisfied with the training.

2.3.2 Item satisfaction The composition ratio and average value of satisfaction of each item were analyzed. The results are shown in Table 3. The trainees showed different satisfaction levels for various aspects of the training. They were most satisfied with the services of the staffs and professional skills of the lecturers, and were least satisfied with the amount of training assignment and one-day course for each training.

2.3.3 Influence of educational background of pharmacist on satisfaction Trainees were divided into subgroups according to their educational background. The analysis showed that the influence of educational background on D2, D10, D12 and D13 was statistically significant ($p<0.05$). The trainees below undergraduate background showed low satisfaction with one-day per training, and were dissatisfied with the short course of 33 classes and 1.65 hours for each class. They recommended that each class should be longer than 3.13 hours. Meanwhile, the trainees with undergraduate background showed low satisfaction with the assignment and mode of submitting assignment. The higher the trainees' educational background, the higher was their satisfaction with the professional skills of the lecturers (Table 4).

2.3.4 Factor analysis for training satisfaction In order to further explore the potential relationship among the 13 items except the overall satisfaction, the satisfaction evaluation data were subjected to factor analysis. After oblique rotation (Tables 5 and 6), the cumulative variance contribution of each factor was 73.78% (factors corresponding to eigenvalue >1 were included), and the commonality of the 13 variables over the three factors exceeded 0.5, which indicated that these three potential factors better summarized the meaning of the 13 items, that is, the 13 indicators actually measured the three dimensions reflecting the training satisfaction.

As shown in Table 5, each indicator shows a high factor load on the corresponding factor. Factor 1 is mainly demonstrated by D1, D2, D3, D4 and D5, which reflects the organization and effectiveness of the training. Factor 2 is mainly demonstrated by D6, D7, D9, D11 and D13, which reflects the teaching mode. Factor 3 includes D8, D10 and D12, which reflects the solidification

and assessment of knowledge gained. These results indicated that the training can be mainly focused on the above-mentioned three factors to improve the overall satisfaction, in order to improve the quality of training.

2.4 Assessment results

A total of 20 courses were included in the training, all of which had a total score of 100 points. The average score of all courses was 89.21±2.62, of which essential points of prescription-checking for cerebrovascular diseases scored highest (average 93.63 points)(Table 7), and essential points of prescription-checking for antibacterial drugs (average 77.63 points) scored lowest.

2.5 Self-evaluation of prescription-checking competency At the time of enrollment, the trainees were asked whether they were qualified for prescription-checking, 90% of trainees believed they were not qualified, and self-evaluated a score below 60 points. Meanwhile, after the training, the trainees self-evaluated an average score of 70.21 points, and 73.33% of them believed they were qualified for prescription-checking (Figure 1).

Multivariate regression was performed by considering the three potential factors in the satisfaction factor analysis as independent variables, and the self-evaluation of prescription-checking competency as dependent variables, which was statistically significant ($F=2.715$, $p=0.047$), with the equation $y=70.267+3.736X_1-1.055X_2+2.105X_3$. This result indicated that the prescription-checking training should focus on organization and development of the training, as well as consolidation and assessment of knowledge.

2.6 Abilities that need improvement for prescription-checking Notably, 48% of the trainees felt a need to improve their ability to be competent in prescription-checking, especially to improve clinical expertise and practical capability, as well as communication skills and ability to search English literature, etc.

2.7 Demand for training knowledge Analysis of demand for training knowledge showed that trainees had highest demand for clinical expertise, and lowest demand for pharmacy basics (Table 8). Relevant analysis of needs for each category with the score of corresponding item showed that the correlation of subject 1-4 (prescription-checking for drugs that require skin test, $r=0.163$, $p=0.047$) with subject 1-5 (prescription-checking for off-label drugs, $r=-0.161$, $p=0.049$) was statistically significant, which indicates that trainees with a higher need for training in these two categories should strengthen their knowledge in these two categories.

2.7.1 Evaluation of offered courses Trainees were asked to score the 20 offered courses according to their perceived importance of the courses. The results are listed in Table 7. The correlation analysis of the importance of courses with the trainees' scores revealed that the course 1-6 (i.e. tools and application of literature search) was statistically significant ($r=0.026$, $\chi^2=0.184$), which suggested that underestimating the importance of the course led to a low score in this course.

Work experience affected evaluation of the importance of the courses. All 10 courses, including prescription-checking related regulations, basic elements, essential points of prescription-checking for high-alert drugs, drugs requiring skin test, off-label drugs, common pediatric drugs, anti-cancer drugs, antibacterial drugs, chronic senile drugs and drugs for arrhythmia were greatly affected by work experience, while the other courses did not show statistical significance (Table 9).

2.7.2 Demand of new courses In addition to the above-mentioned courses, 38.67% of the trainees believed the following knowledge needs to be added in the training: perioperative administration, rheumatism and immunology, nephropathy, microorganism, respiratory disease, liver disease, narcotic drugs, psychoactive drugs, estrogen, oculopathy, dermatologic disease, enteral and parenteral nutrition, gynecological drugs, mental disease, analgesics, ancillary drugs and other drugs for specialized diseases.

2.8 Preferences for teaching organization The trainees favored face-to-face training, which showed a very high average score. Notably, 94.66% of the trainees preferred this mode of teaching, and 63.33% of the trainees liked this teaching mode very much (Table 10).

2.9 Needs for trainers Trainees felt the greatest need for the trainer's professional skills and believed it was the most important, followed by teaching attitudes, methods or means, organization, teaching style and appearance (Table 11).

3. Discussion

The prescription-checking training course in Shanxi Province could quickly and effectively improve the prescription-checking ability of pharmacists in a short period of time using a combination of centralized theory teaching, position practice and online assessment. The present study aimed to investigate the training-related situations of 150 trainees and explore the needs of trainees and key aspects of prescription-checking training, in order to provide a reference for prescription-checking training, improve the quality of continuing education of pharmacists [23], and train qualified pharmacists.

The questionnaire had good internal consistency and validity. The participants came from all districts and counties of the province, which could reflect the basic situation of pharmacists in the entire province. Therefore, the survey results can be used for reference. The training effects were evaluated using three dimensions: satisfaction, examination score and self-evaluation of the trainees in terms of prescription-checking competence. In addition, the needs of trainees for prescription-checking training were analyzed from four dimensions: needs for prescription-checking ability, needs for training contents, teaching mode and needs for trainers.

Overall, the trainees were satisfied with the training. A total of 135 trainees (90%) were satisfied, of which 113 (75.33%) were very satisfied. In contrast to the previous continuing education in the form of conferences, this training links learning with the actual work of prescription-checking. It is a continuing professional development (CPD), which allows trainees to be more autonomous [24], greatly benefits trainees in their work [25–27], and makes them very satisfied. However, the trainees also had different satisfaction levels with various aspects of the training. They were most satisfied with the services of staffs and professional skills of lecturers, but less satisfied with the assignment amount and one-day per training. In addition, trainees with different educational backgrounds had different satisfaction levels for various aspects. The satisfaction evaluation was mainly focused on three factors: training organization, teaching mode as well as consolidation and assessment of knowledge. The analysis showed that it was necessary to focus on strengthening the organization and development of training in order to improve the satisfaction of trainees.

Due to the limited duration and tight schedule, the training might lead to limited improvement in prescription-checking skill and knowledge of pharmacists, but is more likely to increase the confidence of pharmacists [28] who lack confidence [29] in their abilities of prescription-checking and medication suggestion. After the training, the average score for prescription-checking competence was 70.21 points, and 73.33% of the trainees believed they were qualified for prescription-checking. The analysis showed that in order to improve the prescription-checking competence, the training should focus on training organization, consolidation and assessment of knowledge.

In addition to training pharmacists, prescription-checking in medical institutions also relies on the information platform, in which pharmacists can consult the medical record, test results, medical order and other information, as well as communication platform between pharmacists and doctors [29]. Some medical institutions can perform risk pre-judgment using an embedded rational drug use monitoring software, in order to help pharmacists complete prescription-checking during peak hours. Therefore, the support from leadership of medical institutions greatly impacts prescription-checking. However, due to the complexity and variability of clinical diagnosis and treatment, the function of the rational drug use software is very limited. The final results of prescription-checking needs to be judged by the pharmacists after comprehensive analysis. Hence, the prescription-checking pharmacists need to strengthen and update their medical knowledge, and constantly improve their ability. Combining the main contents of this training with the need for knowledge to improve prescription-checking ability, is conducive to determining the key of the prescription-checking training, and providing positive help for pharmacists.

The training included a total of 20 courses, and lecturers spent 1–2 hours to share relevant clinical basic knowledge and typical cases. Each course was assessed (100 points). The trainees showed good performance in assessment, with an average score of 89.21±2.62 points, which indicated a good grasp of the knowledge involved in the courses. The training contents

included medication for common clinical diseases, medication for special population, use of special medicine, relevant laws and regulations, etc. Pharmacists demonstrated different levels of knowledge and needs due to varying work experience. For example, the knowledge of drugs requiring skin test belongs to basic knowledge of pharmacy, and has a high-risk in clinical use. Pharmacists considered it important to gain knowledge, and pay attention to accumulating knowledge during work, which resulted in a good grasp of knowledge and a good examination score. The off-label medication is very common in the clinic, most of which belong to the frontier knowledge of clinical treatment. The pharmacists thought it was important, but lacked related knowledge, which resulted in a low examination score. The pharmacists underestimated the importance of tools and application of literature search, and paid less attention to it, which led to a poor grasp of knowledge and a low examination score. In terms of drug-related laws and regulations as well as commonly used drugs for common clinical diseases, pharmacists with a longer work experience ranked higher importance. Hence, the trainees expected the training knowledge to be related to their work practice [30]. The survey in the present study revealed that the pharmacists had less exposure to clinical basic knowledge and frontier knowledge of disease treatment in their continuing education and daily work, which they generally considered lack of knowledge. Therefore, medication for common clinical diseases [16], frontier knowledge of pharmacy as well as key points in prescription-checking were typically demanded, followed by regulations, query tools and other aspects, while the demand for basic pharmacy knowledge was lowest. Furthermore, supplementary knowledge of tools, such as pharmacy consultation, communication skills [16], drug incompatibility, clinical test and popular science of pharmacy were needed. Prescription-checking is an important part of the pharmacists' services. The training should be patient-centered, and include clinical and therapeutic contents [31], to be in line with the needs of pharmacists. This training was based on clinical basic knowledge and classic prescription cases, which met the needs of pharmacists, and was well received by the trainees.

Regarding other aspects of training organization: (1) Among the tradition teaching methods [17], such as lectures, seminars and remote learning, pharmacists preferred teaching in a face-to-face manner, rather than online, which was similar to the results obtained by Gelayee DA [32], Driesen A [17] and Kassab SE [33]. Face-to-face lecture has advantages such as on-site teaching, and full interaction with lecturers and other trainees. Nonetheless, online courses are constantly evolving, with advantages of freedom of study, anonymity, ease of use, etc.,[34] but overlook the function of interaction [34], which can be considered as a complementary approach to gaining knowledge [35]. Pharmacists in some countries prefer learning online by themselves [16]. (2) In terms of frequency of training and duration of each training, pharmacists with different educational backgrounds expressed different needs. It is recommended that the training can be organized in a stratified manner according to the educational background of trainees. For this training, the duration of each training was two hours, which was generally thought to be short. Trainees recommended that the duration for special courses, such as diabetes [36], should be more than 3.14 hours. (3) In terms of consolidation and assessment of knowledge, pharmacists with different educational backgrounds showed differences in evaluating the assignment amount and examination form. This training was based on practice of checking prescriptions from the pharmacists' medical institution. However, there were fewer patients in some departments of specialized grade 2 medical institutions, which resulted in difficulty in completing the assignment and low satisfaction. (4) Generally, pharmacists had a high requirement for the professional skills of trainers. In this training, trainees were satisfied with the invited lecturers.

Limitations of the survey: (1) The trainees avoided selecting extreme options, which resulted in centralized bias of the scale. (2) The trainees used habitual description, which led to inertial bias of the scale. (3) The trainees might cater to the results expected by the training unit, which might lead to social desirability bias. (4) A higher proportion of trainees came from grade 3 hospitals, and a smaller proportion of trainees came from the primary medical institutions, which might lead to the results closely reflecting the situation of pharmacists from grade 3 hospitals.

4. Conclusion

The pharmacists had a great demand for prescription-checking training. Trainees enrolled in this training showed high satisfaction and good examination results. The key points of prescription-checking training were training organization, as well as consolidation and assessment of knowledge. It is recommended to conduct training in a stratified manner according to

pharmacists' educational background, in order to effectively improve the prescription-checking competence of the pharmacists. The pharmacists favored face-to-face lecture and interaction. It is necessary to supplement clinical disease-related knowledge.

List Of Abbreviations

CPD: continuing professional development.

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files].

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

WC and WJ have drafted the work and collated data; CW and JM have made contributions to analysis and interpretation of data; XY have made contributions to the English translation and revision. BW was a major contributor in writing the manuscript. RH have evaluated the scale or substantively revised it. All authors read and approved the final manuscript.

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Tables

Table 1. Basic information of trainees（n=150）

Category	Number of trainees (n)	Percentage
Gender		
M	37	24.67%
F	113	75.33%
Work experience (years)		
0-5	23	15.33%
6-10	47	31.33%
11-20	49	32.67%
21-30	30	20.00%
≥31	1	0.70%
Educational background		
Below undergraduate	55	36.67%
Undergraduate	75	50.00%
Above undergraduate	20	13.33%
Title		
Assistant pharmacist	2	1.33%
Pharmacist	40	26.67%
Competent pharmacist	81	54.00%
Associate professor of pharmacy	26	17.33%
Professor of pharmacy	1	0.67%
Hospital		
Grade 2	40	26.67%
Grade 3	110	73.33%
Position		
Dispensary for inpatient	39	26.00%
Dispensary for outpatient (emergency)	64	42.67%
Pharmacy intravenous admixture services	19	12.67%

TCM dispensary	11	7.33%
Drug storehouse, procurement	2	1.33%
Others	15	10.00%

Table 2. Reliability of each module

Item	Cronbach-α coefficient
Overall questionnaire	0.963
Satisfaction	0.883
Requirements	0.958
Teaching effect	—

Table 3. Satisfaction score of each item for the training

Item	Composition ratio of satisfaction					Average	Order
	1	2	3	4	5		
D1 Staff services	0.7	0.0	3.3	14.0	82.0	4.77	1
D2 Professional skill of the lectures	0.7	0.0	0.7	21.3	77.3	4.75	2
D3 Group management (notification, collecting assignment)	0.7	0.0	3.3	18.7	77.3	4.72	3
D4 Improvement of prescription-checking ability after the training	0.7	0.0	4.0	22.7	72.7	4.67	4
D5 Improvement of basic knowledge after the training	0.7	0.0	5.3	23.3	70.7	4.63	5
D6 The mode of concentrated lecture	1.3	0.7	3.3	30.0	64.7	4.56	6
D7 Teaching environment	6.7	1.3	2.0	11.3	78.7	4.54	7
D8 Mode of online exam at fixed time every day	0.7	0.7	10.0	38.0	50.7	4.37	8
D9 Face-to-face lecture once a week	4.0	0.7	8.0	31.3	56.0	4.34	9
D10 Mode of submitting assignment	0.7	0.0	8.7	47.3	43.3	4.33	10
D11 2 hours per topic	2.7	4.0	11.3	31.3	50.7	4.23	11
D12 Assignment amount	0.7	0.7	12.7	49.3	36.7	4.21	12
D13 One-day per training	3.3	2.0	15.3	39.3	40.0	4.10	13

Table 4. Influence of educational background on item satisfaction (number and percentage of trainees with a satisfaction of ≥4)

Educational background	N	D13 One-day per training		D12 Assignment amount	D10 Mode of submitting assignment	D2 Professional skills of lecturers
		Average demanded duration（h）	Satisfaction			
Below undergraduate	55	3.23	37（67.27）	50（90.91）	52（94.54）	54（98.18）
Undergraduate	75	3.21	57（76.00）	61（81.33）	64（85.33）	74（98.67）
Above undergraduate	20	2.55	15（75.00）	18（90.00）	20（100.00）	20（100.00）
Average/	χ^2	3.13	6.014	6.725	8.364	11.487
	p		0.049*	0.035*	0.015*	0.003*

Table 5. Variance contributions of factors

Factor	Variance contribution corresponding to the initial eigenvalue			Variance contribution after rotation
	Sum	Variance contribution（%）	cumulative（%）	Sum
1	6.67	51.28	51.28	3.77
2	1.83	14.10	65.37	3.13
3	1.09	8.41	73.78	2.70

Table 6. Factor load matrix after rotation

Indicator	Factor			Commonality
	1	2	3	
D7 Teaching environment	0.259	0.649	-0.197	0.527
D9 Training once a week	0.149	0.875	0.110	0.800
D13 One-day per training	0.085	0.866	0.342	0.874
D11 2 hours per topic	0.200	0.731	0.313	0.673
D6 Training mode of concentrated lecture	0.451	0.594	0.180	0.589
D8 Mode of online exam at fixed time every day	0.301	0.189	0.771	0.721
D12 Assignment amount	0.333	0.142	0.845	0.845
D10 Mode of submitting assignment	0.395	0.119	0.829	0.857
D2 Professional skills of lecturers	0.689	0.233	0.322	0.633
D3 Group management (notification, collecting assignment, etc.)	0.762	0.256	0.303	0.739
D1 Staff services	0.781	0.256	0.162	0.702
D4 Improvement of prescription-checking after training	0.832	0.159	0.326	0.823
D5 Improvement of basic knowledge after training	0.843	0.142	0.280	0.810

Table 7. Transcript and summary of important scores of training courses

No. of course	Course name	N	Assessment							Average score of importance	Order
			Excellent ≥90	Good ≥80	Medium ≥70	Passed ≥60	Failed <60	Average	Sort		
1-1	Prescription-checking related regulations	150	140	10	0	0	0	97.83	5	4.53	20
1-2	Basic elements of prescription-checking	150	131	14	4	1	0	94.46	8	4.61	18
1-3	Essential points of prescription-checking for high-alert drugs	149	142	6	1	0	0	98.29	3	4.72	13
1-4	Essential points of prescription-checking for drugs requiring skin test	149	141	7	1	0	0	96.74	7	4.67	16
1-5	Essential points of prescription-checking for off-label drugs	150	137	2	0	0	1	98.5	2	4.66	17
1-6	Tools and application of literature search	148	102	32	2	6	6	85.67	14	4.59	19
1-7	Essential points of prescription-checking for	150	132	15	2	0	1	93.08	9	4.81	3

	anti-hypertensives										
2-1	Essential points of prescription-checking for intravenous drugs	150	145	5	0	0	0	98.15	5	4.75	11
2-2	Essential points of prescription-checking for common pediatric drugs	149	0	66	70	7	6	75.94	18	4.81	4
2-3	Essential points of prescription-checking for anti-cancer drugs	150	143	7	0	0	0	97.00	6	4.71	14
2-4	Essential points of prescription-checking for anti-bacterial drugs	147	0	8	122	12	5	72.21	20	4.81	5
2-5	Essential points of prescription-checking for drugs in pregnancy and lactation	149	42	33	61	9	4	79.49	17	4.81	6
3-1	Essential points of prescription-checking for drugs for	149	148	0	0	0	1	98.99	1	4.79	9

	cerebrovascular diseases										
3-2	Essential points of prescription-checking for TCM (patented drugs)	150	46	57	34	9	4	81.78	16	4.70	15
3-3	Essential points of prescription-checking for drugs for digestive system	149	0	19	122	5	3	75.80	19	4.78	10
3-4	Essential points of prescription-checking for drugs for coronary heart diseases	150	80	47	18	3	2	86.68	13	4.83	1
4-1	Essential points of prescription-checking for drugs for chronic senile diseases	147	67	71	9	0	0	87.89	12	4.81	7
4-2	Essential points of prescription-checking for glucocorticoids	149	106	41	1	1	0	89.97	11	4.82	2
4-3	Essential points of use and prescription-checking for	147	60	56	24	5	2	84.64	15	4.80	8

	drugs for diabetes										
4-4	Essential points of prescription-checking for drugs for arrhythmia	149	96	26	26	1	0	90.42	10	4.74	12

Table 8. Needs for training categories

Topic/option	1	2	3	4	5	Average
Clinical expertise training	10（6.67%）	5（3.33%）	14（9.33%）	27（18.00%）	94（62.67%）	4.27
Special training on prescription-checking cases	6（4.00%）	7（5.03%）	22（14.67%）	32（21.33%）	83（55.33%）	4.19
Training on frontier knowledge in pharmacy	5（3.33%）	7（4.67%）	25（16.67%）	44（29.33%）	69（46.00%）	4.10
Training on other relevant professional knowledge (such as use of information tools, literature search, etc.)	4（2.67%）	8（5.33%）	29（19.33%）	50（33.33%）	59（39.33%）	4.01
Training on communication skills	6（4.00%）	17（11.33%）	38（25.33%）	46（30.67%）	43（28.67%）	3.69
Training on ‘three basic skills’ in pharmacy	13（8.67%）	14（9.33%）	39（26.00%）	37（24.67%）	47（31.33%）	3.61
Sum	44（4.89%）	58（6.44%）	167（18.56%）	236（26.22%）	395（43.89%）	3.98

Table 9. Effect of work experience on evaluation of importance of courses (number of trainees scored importance ≥4)

Work experience	N	1-1	1-2	1-3	1-4	1-5	2-2	2-3	2-4	4-1	4-4
0-5	23	17	18	20	19	21	22	19	22	22	21
6-10	47	42	44	46	44	45	47	45	47	47	45
11-20	49	47	47	48	48	47	49	49	49	49	49
≥21	31	31	31	3	30	30	30	30	30	30	30
χ^2		14.780	20.633	14.546	11.781	16.171	11.829	16.423	9.873	9.982	12.496
p		0.005*	<0.001*	0.006*	0.019*	0.003*	0.019*	0.003*	0.043*	0.041*	0.014*

Table 10. Scoring of teaching organization (number and percentage of trainees with a satisfaction score of ≥4)

Topic/option	Very disliked	Disliked	Normal	Liked	Very liked	Average score
Face-to-face	2（1.33%）	1（0.67%）	5（3.33%）	47（31.33%）	95（63.33%）	4.55
Out training	1（0.67%）	0（0.00%）	31（20.67%）	60（40.00%）	58（38.67%）	4.16
Seminar	1（0.67%）	4（2.673%）	34（22.67%）	63（42.00%）	48（32.00%）	4.02
Visiting	2（1.33%）	3（2.00%）	38（25.33%）	56（37.33%）	51（34.00%）	4.01
Annual conference	1（0.67%）	4（2.67%）	36（24.00%）	65（43.33%）	44（29.33%）	3.98
Remote/online	3（2.00%）	11（7.33%）	39（26.00%）	54（36.00%）	43（28.67%）	3.82
Long-term correspondence class	2（1.33%）	5（3.33%）	55（36.67%）	53（35.33%）	35（23.33%）	3.76
Evening lecture	4（2.67%）	12（8.00%）	54（36.00%）	53（35.33%）	27（18.00%）	3.58
Sum	16（1.33%）	40（3.33%）	292（24.33%）	451（37.58%）	401（33.42%）	3.98

Table 11. Needs for professional abilities of trainers (n number of trainees scored importance ≥4)

Topic/option	Very unimportant	Unimportant	Normal	Important	Very important	Average
Professional skills	1(0.67%)	0(0%)	1(0.67%)	14(9.33%)	134(89.33%)	4.87
Teaching attitudes	1(0.67%)	0(0%)	2(1.33%)	21(14%)	126(84%)	4.81
Teaching methods or means	1(0.67%)	0(0%)	4(2.67%)	25(16.67%)	120(80%)	4.75
Organization	1(0.67%)	0(0%)	3(2.00%)	38(25.33%)	108(72%)	4.68
Teaching style	1(0.67%)	0(0%)	5(3.33%)	36(24.00%)	108(72%)	4.67
Appearance	1(0.67%)	2(1.33%)	15(10%)	67(44.67%)	65(43.33%)	4.29
Sum	6(0.67%)	2(0.22%)	30(3.33%)	201(22.33%)	661(73.44%)	4.68

Figures

Figure 1

Self-evaluation of trainees for prescription-checking competency. The histogram shows the self-evaluation of qualification for prescription-checking. The score ranges 0-100 points, the X axis represents five fractions, the Y axis represents the number of trainees, which is divided into four segments.