

Multi-center survey on the training status of staff working in pharmacy intravenous admixture services (PIVAS) in mainland China

Perspectives of PIVAS staff

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Abstract

The technical level and comprehensive quality of pharmacy intravenous admixture services (PIVAS) staff are central to ensure the safety and effectiveness of intravenous infusions. However, these aspects are lacking in traditional pharmacy education. This study aimed to investigate the training status of staff working in PIVAS and explore factors that affected training status, which might contribute to the establishment of a comprehensive, standardized training system.

A multi-center cross-sectional survey was conducted via a WeChat Group targeting PIVAS staff in hospitals to investigate the differences of current training status between different regions, hospital levels, genders, job titles, educational degrees, employment types, and working years.

In total, 501 participants completed the questionnaires. The main contents of training for PIVAS staff included: professional theoretical knowledge (99.40%, 498/501), practical operation abilities (97.01%, 486/501), pre-job training (92.61%, 464/501), and standard operating procedures (90.22%, 452/501). The most common frequency of staff training was 1–2 times a month (51.9%, 260/501). Overall, 56.5% (283/501) of participants thought staff training was sufficient and 60.1% (301/501) of participants thought PIVAS attached importance to staff training. However, only 45.7% (229/501) of the participants were satisfied with the training modes.

The contents of training for PIVAS staff in mainland China were relatively rich, but the aspects of management tools, comprehensive ability development, and career development planning tend to be relatively weak. It is necessary to develop training standards for PIVAS staff to improve employee capabilities and job satisfaction.

Abbreviation: PIVAS = pharmacy intravenous admixture services.

Keywords: China, education, hospital administration, pharmacy intravenous admixture service, survey

1. Introduction

Pharmacy intravenous admixture services (PIVAS) is a hospital-based comprehensive and technical pharmaceutical department. Pharmacists review medical orders and conduct centralized admixture of intravenous drugs (eg, general drugs, cytotoxic

drugs, antibiotics, and total parenteral nutrition) in accordance with sterile operation standards and under clean environment conditions to provide intravenous infusions for patients.^[1] With the rapid growth of intravenous infusion therapy in recent years, the emergence of new drugs and the increasing types of

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All participants completed and signed an informed consent form before the survey started. This study was approved by the Institutional Review Board of West China Second University Hospital, Sichuan University.

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The datasets generated and/or analyzed during the present study are not publicly available because they are subject to the West China Second University Hospital, Sichuan University. However, the data and materials are available from the corresponding author on reasonable request.

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intravenous drug compatibility means that the complexity of intravenous admixture services is augmenting.

The technical level and comprehensive quality of PIVAS staff are central to ensure the safety and effectiveness of intravenous infusions.^[2] Intravenous admixture service requires pharmaceutical and medical expertise, as well as aseptic operation technology and intravenous admixture technology. However, these aspects are lacking in traditional pharmacy education. Therefore, staff training might be a new opportunity for PIVAS staff.

In 2019, Yang et al.^[3] conducted a systematic review about the training situation of PIVAS staff in mainland China. After a comprehensive literature search and screening, they included 5 related studies that reported training objectives included: the comprehensive quality training, the level of clinical rational use of drugs, the training pathways of pharmacy staff, and the professional service abilities. However, they found the specific training contents of training modes varied, with the main components including professional theoretical knowledge, practical operation ability, pre-job training, professional psychological quality, professional ethics and laws and regulations, continuing education learning ability, career development planning, and teaching ability. There were also great differences in the evaluation indicators of training effectiveness, which were mainly reflected in team execution motivation and creativity, the discovery rate of unreasonable doctor's advice, work efficiency, service quality, drug treatment level, satisfaction of PIVAS, etc.^[3] However, that review included early studies and single-center studies were not well-represented, meaning those articles could not reflect the overall training status of PIVAS staff in China. In addition, it was uncertain whether there were differences in training content and modes between different hospital levels and regions of China.

We proposed a hypothesis that the training status of staff working in PIVAS needs urgent attention and certain factors are closely related to the training status. To make up for the shortcomings of previous studies, we conducted a multi-center cross-sectional survey to investigate the training status of staff working in PIVAS, and explored factors that affected training status. Our findings will provide reference information for the comprehensive and standardized training system of PIVAS staff in mainland China.

2. Methods

2.1. Study design

This multi-center cross-sectional survey was conducted in mainland China from March to April 2019. Pharmacists or nurses working in PIVAS of hospitals across mainland China were selected as participants.

This study used a self-designed questionnaire. First, the questionnaire was preliminarily designed by referring to the results of the system review we completed earlier.^[3] Then, the questionnaire was discussed together by PIVAS experienced staff, leaders, and methodologists. Finally, the deficiencies of contents were improved through a pre-experiment. The content of the final questionnaire included: 1) basic participant information: region, hospital level, gender, job title, education degree, employment type, and working years and 2) current status of staff training: the frequency of staff training, whether training for PIVAS staff was sufficient, whether PIVAS attached importance to staff training, whether PIVAS staff had opportunities to attend academic

conferences, the training modes of PIVAS staff, and the degrees of satisfaction with PIVAS training.

The electronic questionnaire was made, distributed, and collected through the questionnaire platform powered by www.wjx.cn. The questionnaires were distributed to the WeChat group named the Intravenous Dispensing Management and Application Branch of the China Medical Education Association, all members of which were engaged in PIVAS related work. We set up a lottery at the end of the survey to improve the enthusiasm of participants and the effectiveness of the questionnaire. This is an anonymous survey, and each internet protocol address could only be filled the questionnaire in once. The original data can be exported and analyzed through the questionnaire platform.

2.2. Statistical methods

We used *t* tests or analysis of variance for continuous variables with normally distributed data, and expressed the results as $x \pm s$. If the data were not normally distributed, we used the rank-sum test. Chi-squared tests were used for categorical variables. The difference was considered statistically significant at $P < .05$. We used SPSS version 21.0 (SPSS Inc., Chicago, IL) for the data analyses.

3. Results

3.1. Basic information about participants

In total, we received 501 questionnaires. Participants came from 24 provinces, with 56.1% (281/501) from eastern China, 27.5% (138/501) from western China, and 16.4% (82/501) from central China. Most (91.0%, 456/501) participants worked in Level III hospitals, and the remainder (9.0%, 45/501) worked in Level II hospitals. Most (75.8%, 380/501) participants were female. Participants' job titles included: the senior title (1.6%, 8/501), the deputy title (5.0%, 25/501), the intermediate title (22.2%, 111/501), the junior title (49.5%, 248/501), the pre-junior title (19.0%, 95/501), and none (2.8%, 14/501). Few participants (0.8%, 4/501) had a doctor's degree, 6.2% (31/501) had a master's degree, 72.5% (363/501) had a bachelor's degree, and 20.6% (103/501) had a junior college's degree or below. The employment types were permanent staff (21.4%, 107/501), agency personnel (11.4%, 57/501), contract labors (49.1%, 246/501), labor dispatch personnel from the third party (17.4%, 87/501), and personnel in standardized training (0.8%, 4/501). The length of working years in PIVAS ranged from 0.08 to 35 years (4.26 ± 3.56 years), with a median of 3 years.

3.2. Basic information about staff training

The contents of PIVAS staff training included: professional theoretical knowledge (99.40%, 498/501), practical operation ability (97.01%, 486/501), pre-job training (92.61%, 464/501), standard operating procedures (90.22%, 452/501), scientific research capacity (79.24%, 397/501), emergency management planning (75.65%, 379/501), occupational mental health, work ethics and laws/regulations (72.46%, 363/501), management systems (62.48%, 313/501), communication skills (48.90%, 245/501), teaching ability (47.31%, 237/501), management ability (44.91%, 225/501), management tools (35.73%, 179/501), comprehensive ability development (32.73%, 164/501), and career development planning (20.96%, 105/501).

The training modes of PIVAS included: lectures (85.83%, 430/501), practical operations (75.85%, 380/501), seminars (35.93%, 180/501), online teaching (19.76%, 99/501), continuing education training (26.95%, 135/501), and other (1.60%, 8/501).

The most common frequency of staff training was 1–2 times a month (51.9%, 260/501), followed by 3–4 times a month (25.5%, 128/501). Overall, 56.5% (283/501) of the participants thought PIVAS training was sufficient, and 60.1% (301/501) of the participants thought PIVAS attached importance to staff training. Most (93.4%, 468/501) participants had opportunities to participate in out-of-hospital training, of which 22.2% (111/501) thought the opportunities were sufficient. The main modes for out-of-hospital training were academic conferences (62.8%, 294/468) and continuing education (18.8%, 88/468). However, only 45.7% (229/501) of the participants were satisfied with the training modes (see Table 1).

3.3. Factors affecting staff training

The chi-squared test compared the training status in different regions, showing that more staff in eastern China thought the training was sufficient compared with those in central China, while more staff in central China felt the training was sufficient compared with those in western China, with a significant difference ($\chi^2=9.910$, $P=.042$). Staff in eastern China had more opportunities for out-of-hospital training than those in central China, while those in central China had more learning opportunities than those in western China, with a significant difference ($\chi^2=14.658$, $P=.023$). The frequency of academic conferences in central China was higher than that in the eastern

region, while that in eastern China was higher than that in western China ($\chi^2=41.045$, $P=.000$) (see Table 2).

The chi-squared test compared the training status in hospitals with different levels, showing there was a significant difference in the frequency of staff training between Level III hospitals and Level II hospitals ($\chi^2=14.077$, $P=.007$) (see Table 2).

The chi-squared test compared the training status in different genders, showing there was a significant difference between different genders in the training modes ($\chi^2=15.971$, $P=.001$) (see Table 3).

The chi-squared test compared the training status of PIVAS staff with different job titles, showing that more PIVAS staff with intermediate and junior titles thought PIVAS training was sufficient than those with senior titles, with a significant difference ($\chi^2=35.846$, $P=.000$). In addition, more PIVAS staff with intermediate and junior titles thought that PIVAS attached importance to staff training than those with senior titles ($\chi^2=25.657$, $P=.004$). PIVAS staff with intermediate and junior titles had more opportunities to attend academic conferences than those with senior titles ($\chi^2=32.326$, $P=.006$). There was a significant difference between different job titles in the training modes ($\chi^2=49.398$, $P=.000$). PIVAS staff with senior titles were more satisfied with the training than those with intermediate and junior titles, and the difference was significant ($\chi^2=35.504$, $P=.000$) (see Table 3).

The chi-squared test compared the training status of PIVAS staff with different education degrees, showing that PIVAS staff with a master's degree had significantly more opportunities to attend academic conferences than those with a bachelor's degree and below ($\chi^2=17.983$, $P=.035$). There was a significant difference between different education degrees in the training modes ($\chi^2=37.460$, $P=.000$). PIVAS staff with doctor and master's degrees were more satisfied with the PIVAS training than those with a bachelor's degree and below ($\chi^2=16.748$, $P=.010$) (see Table 4).

The chi-squared test compared the training status of PIVAS staff with different employment types, showing that more contract labors, labor dispatch personnel from the third party, and personnel in standardized training thought PIVAS training was sufficient than permanent staff and agency personnel ($\chi^2=41.283$, $P=.000$). There was a significant difference between different employment types in the training modes ($\chi^2=29.103$, $P=.004$) (see Table 4).

The rank-sum test compared the training status of PIVAS staff with different working years, showing there was a significant difference between PIVAS staff with different working years in the frequency of staff training, whether PIVAS training was sufficient, whether PIVAS attached importance to staff training, whether PIVAS staff had opportunities to attend academic conferences, and satisfaction with PIVAS training. The frequency of staff training appeared to be lower among PIVAS staff with longer working years ($F=9.519$, $P=.049$). More participants with longer working years thought that the PIVAS training was sufficient compared with those with shorter working years, with a significant difference ($F=14.987$, $P=.001$). PIVAS staff with shorter working years thought PIVAS attached more importance to staff training ($F=11.142$, $P=.004$). PIVAS staff with shorter working years also had more opportunities to attend academic conferences ($F=2.687$, $P=.046$) and were more satisfied with PIVAS training ($F=5.507$, $P=.004$) than other participants. There was a significant difference between PIVAS staff with different work years in the training modes ($F=16.048$, $P=.001$) (see Table 5).

Table 1

Basic information of staff training.

Item	Option	Percentage (frequency/total)
Frequency of staff training	<1 time a month	13.8% (69/501)
	1–2 times a month	51.9% (260/501)
	3–4 times a month	25.5% (128/501)
	≥5 times a month	8.0% (40/501)
	Other	0.8% (4/501)
Whether training in PIVAS was sufficient	Insufficient	12.2% (61/501)
	Sufficient	56.5% (283/501)
Whether PIVAS attached importance to staff training	Not important	10.6% (53/501)
	Important	60.1% (301/501)
Whether PIVAS staff had opportunities to attend academic conferences	No	6.6% (33/501)
	Yes	93.4% (468/501)
Mode of training for PIVAS staff	Less	37.7% (189/501)
	General	33.5% (168/501)
	Many	22.2% (111/501)
	Academic conference	62.8% (294/468)
	Continuing education	18.8% (88/468)
Satisfaction with PIVAS training	Professional training	17.1% (80/468)
	Others	1.3% (6/468)
	Unsatisfied	6.2% (31/501)
	Satisfied	45.7% (229/501)
	General	48.1% (241/501)

Table 2**The effect of regions and hospital levels on PIVAS staff training status.**

Item	Option	Eastern China	Western China	Central China	χ^2	<i>P</i>	Level III Grade A hospitals	Level II Grade A hospitals	χ^2	<i>P</i>
Frequency of staff training	<1 time a month	35	25	9	8.042	.429	66	3	14.077	.007
	1–2 times a month	150	63	47			226	34		
	3–4 times a month	74	33	21			122	6		
	≥5 times a month	20	16	4			39	1		
	Other	2	1	1			3	1		
Whether training in PIVAS was sufficient	Insufficient	31	21	9	9.910	.042	51	10	4.263	.119
	Sufficient	175	65	43			262	21		
Whether PIVAS attached importance to staff training	Not important	30	15	8	0.370	.985	48	5	2.844	.241
	Important	171	82	48			279	22		
Whether PIVAS staff had opportunities to attend academic conferences	No	26	6	1	14.658	.023	29	4	6.182	.103
	Less	103	50	36			170	19		
	General	84	56	28			150	18		
	Many	68	26	17			107	4		
Mode of training for PIVAS staff	Academic conference	160	69	65	41.045	.000	275	19	7.155	.067
	Continuing education	55	17	8			71	9		
	Professional training	39	44	5			75	13		
	Others	1	2	3			6	0		
Satisfaction with PIVAS training	Unsatisfied	14	7	10	5.951	.203	29	2	0.674	.714
	General	132	70	39			217	24		
	Satisfied	135	61	33			210	19		

Table 3**The effect of genders and job titles on PIVAS staff training status.**

Training Item	Option	Male	Female	χ^2	<i>P</i>	Senior title	Deputy title	Intermediate title	Junior title	Pre-Junior title	None	χ^2	<i>P</i>
Frequency of staff training	<1 time a month	16	53	3.983	.408	1	4	17	38	7	2	17.332	.631
	1–2 times a month	67	193			4	15	60	119	54	8		
	3–4 times a month	24	104			2	5	27	68	22	4		
	≥5 times a month	13	27			1	1	5	21	12	0		
	Other	1	3			0	0	2	2	0	0		
Whether training in PIVAS was sufficient	Insufficient	14	47	1.854	.386	3	6	19	27	6	0	35.846	.000
	Sufficient	63	220			2	9	56	137	65	14		
Whether PIVAS attached importance to staff training	Not important	14	39	0.163	.922	1	5	8	28	11	0	25.657	.004
	Important	72	229			4	13	61	144	65	14		
Whether PIVAS staff had opportunities to attend academic conferences	No	6	27	1.624	.664	0	0	7	16	10	0	32.326	.006
	Less	50	139			2	13	42	100	31	1		
	General	41	127			3	8	38	82	35	2		
	Many	24	87			3	4	24	50	19	11		
Mode of training for PIVAS staff	Academic conference	89	205	15.971	.001	6	23	79	148	30	8	49.398	.000
	Continuing education	11	69			1	1	12	40	24	2		
	Professional training	13	75			1	1	12	40	30	4		
	Others	2	4			0	0	1	4	1	0		
Satisfaction with PIVAS training	Unsatisfied	9	22	0.723	.696	2	2	4	17	6	0	35.504	.000
	General	60	181			1	12	65	129	33	1		
	Satisfied	52	177			5	11	42	102	56	13		

Table 4
The effect of education degrees and employment types on PIVAS staff training status.

Item	Option	Doctor's degree			Bachelor's degree			Junior college's degree and below			Labor dispatch			χ^2/F	P
		0	3	58	8	12,338	.419	17	6	39	6	1	26,005		
Frequency of staff training	<1 time a month	0	3	58	8	12,338	.419	17	6	39	6	1	26,005	.054	
	1-2 times a month	3	18	186	53			57	22	126	55	0			
	3-4 times a month	1	7	89	31			25	23	56	22	2			
	>5 times a month	0	2	27	11			7	5	24	3	1			
Whether training in PIVAS was sufficient	Other	0	1	3	0			1	1	1	1	0			
	Insufficient	1	6	46	8	7.821	.251	26	5	26	4	0	41.283	.000	
	General	1	10	120	26			44	20	73	20	0			
Whether PIVAS attached importance to staff training	Sufficient	2	15	197	69			37	32	147	63	4			
	Not important	1	0	43	9	10.993	.089	12	9	22	10	0	13.260	.103	
	General	1	12	109	9			41	16	63	27	0			
Whether PIVAS staff had opportunities to attend academic conferences	Important	2	19	211	69			54	32	161	50	4			
	No	0	0	25	8	17.983	.035	6	6	10	11	0	17.325	.138	
	Less	2	8	147	32			49	17	90	31	2			
	General	2	10	122	34			35	19	87	25	2			
Mode of training for PIVAS staff	Many	0	13	69	29			17	15	59	20	0			
	Academic conference	3	24	232	35	37.460	.000	73	35	151	35	0	29.103	.004	
	Continuing education	1	4	50	25			12	8	35	24	1			
	Professional training	0	3	52	33			16	7	46	16	3			
Satisfaction with PIVAS training	Others	0	0	4	2			0	1	4	1	0			
	Unsatisfied	1	1	24	5	16.748	.010	9	3	17	2	0	13.293	.102	
	General	0	15	189	37			56	29	118	38	0			
Satisfied	3	15	150	61			42	25	111	47	4				

Table 5
The effect of working years on PIVAS staff training status.

Item	Option	working years	F	P
Frequency of staff training	<1 time a month	5.017 ± 3.590	9.519	.049
	1–2 times a month	4.327 ± 4.038		
	3–4 times a month	4.059 ± 2.704		
	≥5 times a month	2.992 ± 2.084		
	Other	5.500 ± 2.887		
Whether training in PIVAS was sufficient	Insufficient	3.432 ± 0.439	14.987	.001
	General	5.089 ± 4.255		
	Sufficient	3.754 ± 3.052		
Whether PIVAS attached importance to staff training	Not important	4.249 ± 3.476	11.142	.004
	General	5.037 ± 4.244		
	Important	3.876 ± 3.133		
Whether PIVAS staff had opportunities to attend academic conferences	No	4.126 ± 2.773	2.687	.046
	Less	4.500 ± 3.374		
	General	4.548 ± 4.005		
	Many	3.340 ± 3.257		
Mode of training for PIVAS staff	Academic conference	4.781 ± 3.980	16.048	.001
	Continuing education	3.221 ± 2.880		
	Professional training	3.489 ± 2.452		
	Others	4.383 ± 3.250		
	Unsatisfied	4.612 ± 2.904		
Satisfaction with PIVAS training	General	4.750 ± 3.396	5.507	.004
	Satisfied	3.685 ± 3.734		

4. Discussion

This was a multi-center cross-sectional survey of PIVAS staff training in mainland China. A total of 501 PIVAS staff from western, central, and eastern China participated in this survey. The content of staff training in PIVAS included professional theoretical knowledge, practical operation ability, pre-job training, and standard operating procedures. However, some aspects of the training content were considered insufficient, including communication skills, teaching ability, management ability, management tools, comprehensive ability development, and career development planning. The main modes of PIVAS training were lectures and practical operations, and the most common frequency of staff training was 1–2 times a month. More than half of the participants thought that PIVAS training was sufficient and thought PIVAS attached importance to staff training. The majority of PIVAS staff had opportunities to attend academic conferences to learn, but less than half were satisfied with the modes of PIVAS training.

PIVAS has become a new model of pharmacy services with modern equipment and advanced management concepts; however, higher requirements are put forward for the knowledge structure and skill level of PIVAS staff.^[4,5] The “Regulations on the Quality Management of Centralized Dispensing of Intravenous Drugs” published by the Ministry of Health of China stated that PIVAS staff must receive professional knowledge training, and must pass the exam before they can engage in PIVAS, and must regularly receive continuing education in pharmacy.^[6] Therefore, the main content of staff training in this survey was to meet the national policy’s requirements and the needs of actual work; however, the training frequency was low and the training modes and contents were simple, which may be directly related to PIVAS staff’s heavy workload and high work pressure.^[7]

Factors affecting PIVAS staff training in this survey showed that more participants in eastern China and in Level III hospitals

thought the frequency of PIVAS training was sufficient, compared with participants in central and western China and in Level II hospitals. Staff in eastern China also had more opportunities to attend academic conferences than staff in other regions, which may be related to the economic level of different regions and hospital levels.^[8] PIVAS located in regions with higher economic levels and higher-level hospitals may have more learning resources and sufficient funds to support staff to attend professional training and other learning opportunities. The proportion of adequate training, the importance attached to training, and the opportunities for study outside among PIVAS staff with junior and intermediate titles were more than those with senior titles. It may be due to the fact that PIVAS staff with junior and intermediate titles have less accumulated experience and knowledge than those with senior titles, so they need more training and learning opportunities. Staff with higher job titles were also more satisfied with PIVAS training than other staff. PIVAS staff with master’s degrees had more opportunities to attend academic conferences than those with lower academic qualifications. Staff with doctor or master’s degrees were more satisfied with PIVAS training than other staff. It may be due to the fact that staff with doctor or master’s degrees have better scientific research consciousness, stronger scientific research abilities, and more scientific research output, meaning they may have more opportunities to attend academic conferences.^[9]

As the time of working in PIVAS grows, PIVAS staff may become more proficient in the basic skills and gain rich clinical experience, meaning their desire and demand for learning may decline. Staff with shorter working years may need to acquire more knowledge and be required to participate in more training, meaning they may be more satisfied with PIVAS training.

This study had some limitations in terms of methodology. First, we used a cross-sectional design, which failed to make causal inferences. It is necessary to conduct a prospective study to explore the training effect of PIVAS and factors that affect staff

training. Second, we could not use random sampling to recruit PIVAS staff, because no complete list of PIVAS staff is available. However, our study included more than 500 participants from eastern, western, and central China, which means that the results are representative to some extent. Further research should be designed to overcome these limitations.

5. Conclusion

The training content of PIVAS staff in China is relatively rich and sufficient, but management tools, comprehensive ability development, and career development planning are relatively weak. Overall, the training modes are simple, and satisfaction with training is not high. It is necessary to develop PIVAS staff training standards to improve employee capabilities and job satisfaction.

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Author contributions

XN and CY designed the study, collected data, carried out analysis and interpretation of the data, and wrote the article. WM and LZ designed the study, collected data, checked the data, and wrote the article.

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References

- [1] Zhao P. Experience in training of pharmacy intravenous admixture services. *Strait Pharm J* 2013;25:274–5.
- [2] Han YX, Zhu LS, Li N, et al. Establishment and practice of professional and technical personnel training system for PIVAS in hospitals. *Southwest Natl Defen Med* 2017;27:631–3.
- [3] Yang CS, Zhang LL, Lin YZ, et al. Evidenced-based evaluation of personnel training mode in pharmacy intravenous admixture services in China. *China Pharm* 2019;30:708–11.
- [4] Yu SY, Feng ZP. Discussion on the training program for pharmaceutical personnel in intravenous allocation center of our hospital. *Strait Pharm J* 2016;28:271–3.
- [5] Zhang J, Hou JH, Yin JF, et al. Formulation of PIVAS acceptance criteria and establishment of the personnel training and assessment method in Yunnan Province. *China Pharm* 2011;22:4233–5.
- [6] Zhu HJ. Discussion on the training of pharmaceutical technicians in pharmacy intravenous admixture services. *China Licensed Pharm* 2012;9:52–5.
- [7] Bian LJ. How to improve the utilization and quality cultivation of nursing manpower in PIVAS. *J Qiqihar Univ Med* 2015;35:599–600.
- [8] Pang ZM, Guo SY, Lou BQ. Research on service status of intravenous drug allocation center in Chinese hospitals. *Health Med Res Pract* 2015;12:22–6.
- [9] Zheng LG. Retrospective literature analysis on the development of pharmaceutical research in domestic hospitals. *China Health Manag* 2011;28:146–8.