



Evaluation of the Clinical Nurse Specialists Training Program in Pediatric Intensive Care Units in China: Quantitative Results from Participants' Perspectives

Cangcang Fu¹, Jihua Zhu¹ and Nan Lin^{1,*}

¹Nursing Department, Children's Hospital, Zhejiang University School of Medicine, Hangzhou, China

*Corresponding author: Children's Hospital, Zhejiang University School of Medicine, Hangzhou, China. Email: 6520030@zju.edu.cn

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Abstract

Background: This study aimed to systematically evaluate the effectiveness of a clinical nurse specialists training program in Zhejiang Province, China, from participants' perspectives.

Methods: This cross-sectional study was conducted with 209 PICU nurse specialists who participated in the training program from 2016 to 2021. All participants completed an online questionnaire two years after graduation. We collected their demographic characteristics and their development status after the training (e.g., continuous improvement of core competence, research skills, and promotion). Chi-squared test was applied to assess the differences in effectiveness across subgroups.

Results: In total, 209 (87.8%) out of 238 nurses responded to the survey among whom 73.7% launched new projects in their hospital after training and 75% published research articles in peer-reviewed journals. Also, 32.4% received promotions, and 67% participated in ICU-related continuing education programs. Based on multivariate regression analysis, the execution of new projects was closely related to the nurse's position and the level of their working hospitals. The job title and position were associated with publication, research performance, promotion, and continuing education.

Conclusions: The nurse specialists of the PICU carried out a set of new projects implanting new skills that they had learned from the training program. Their core competence was improved, including theoretical knowledge and operation skills, teaching capacities, and scientific research abilities. Many trainees published papers, applied for research grants, got promotions, and had further opportunities for continuing education.

Keywords: Clinical Nurse Specialist, Pediatrics, Intensive Care Unit, Training Program, Core Competency

1. Background

According to the latest guidelines on advanced practice nursing, a clinical nurse specialist (CNS) is an advanced practice nurse who provides expert clinical advice and care based on established diagnoses in specialized clinical fields along with a systems approach in practicing as a member of the health care team (1). The concept of CNS was initially created by the United States in the 1980s. Then a series of training programs were developed to improve patient care, and eventually, the U.S. established the most efficient system (2). CNSs usually hold a completed educational diploma at the graduate level (e.g., Master of Science) or postgraduate one (i.e., Doctor of Nursing Practice) and pass at least 500 hours of clinical nursing practice (3-5) They are experts who apply practical, theoretical, and evidence-based interventions to the care of patients within a specialty clinical area (6, 7). Practically, CNSs play various

essential roles in clinical practice, not only as nurses but also as consultants, educators, researchers, clinical administrators, etc. (4, 8-11). Accordingly, many countries have been committed to develop training curricula for cultivating professional CNSs (12-14). In Finland, the expanded role of CNSs includes advanced clinical skills and responsibility for health education and promotion, supervision, leadership, and research (13). Based on a global study on roles, regulations, education, and practice of advanced practice nurses, they play an essential role in achieving the sustainable development goal of universal health coverage (14). Meanwhile, the relevant data from China was quite limited in this study.

In China, the concept of CNS was introduced in 1996, and further developments have relatively fallen behind (15). The educational pattern and specialist system still had to be built up. In China, the number of registered nurses was 4.7 million, which corresponded to 3.34 regis-

tered nurses per thousand in 2020 (16). More than 70% of registered nurses have a secondary educational level or above, and those with a college degree account for 1.4%, while there is a low number of nurses with an academic diploma (16). Hence, the low number of CNSs in China can hardly meet the increasing need for medical care.

Since 2000, CNS training programs were launched in several specialty nursing fields, including emergency care, intensive care units (ICUs), and diabetes in Zhejiang Province, China. The Zhejiang Provincial Health Commission established the children's hospital where the study was conducted, and the Zhejiang Provincial Nursing Association was the first CNS training center. The outline of development plan of Chinese nursing care (2021 - 2025) has highlighted the urgent need to cultivate nurses specialized in pediatric nursing, ICU, emergency care, etc. (16). Nurses working in the pediatric intensive care unit (PICU) take care of critically ill infants, children, and teenagers. Thus, the PICU requires medical physicians, specialists, and nursing staff with higher qualification standards. A PICU nursing specialist training program was launched in 2010 in Zhejiang Province to improve the nursing abilities in the PICU. This four-month training program contained two parts: A theoretical course (1 month) and clinical practice (3 months). At the end of the course, the trainee should pass a series of examinations regarding theoretical, operational, and research skills and defend one's project. The certificate of CNS is granted to the qualified trainee. Thus far, there are around 500 participants who have successfully passed the course and got their CNS certificate. However, the effect of the CNS training program has not been systematically evaluated.

2. Objectives

This study aimed to investigate the effect of a CNS training program among PICU nurses in terms of influences on the nursing core competency, knowledge, skills, promotion, etc., and provided evidence to further improvements of the design and effects of such training programs.

3. Methods

3.1. Study Design and Participants

In this descriptive cross-sectional study, 238 PICU nurses were selected for the PICU nurse specialist training program in the university-affiliated children's hospital in Zhejiang, China, through a convenience sample. The inclusion criteria for this study were (1) those nurses with a secondary educational diploma and more than eight years of working experience in clinical nursing, or those with a bachelor's degree and more than five years of experience in

clinical nursing; (2) the nurses with at least three years of work experience in PICU; and (3) the ones who had graduated from the training program for two years. They were from 23 different hospitals all over China who had PICU nurse specialist certificate. The study was conducted according to the Declaration of Helsinki and was approved by the Ethics Committee of the Children's Hospital, Zhejiang University School of Medicine (2022-IRB-187). This was a cross-sectional study according to the STROBE checklist.

3.2. Data Collection

This study was conducted using a mobile app-based survey (Wenjuanxing, www.wjx.cn), the invitations of which were sent through national and local organizations. Considering the required time for publication and job promotion, we sent questionnaires to each participant 2 years after graduation to gain more information about their post-program personal development. All the participants were fully informed about the study aims and protocol. Also, they had to indicate their tendency to participate in the study by ticking "yes" or "no" on the first page of the questionnaire before filling in the electronic questionnaire. The completed questionnaires were provided as Appendix 1 in the supplementary file. We limited the electronic questionnaire and required participants to complete all items before submitting the questionnaire. Therefore, the response rate for each item of the recovered questionnaire was 100%.

3.3. Measures

The survey instrument was developed based on the literature review and experts' opinions (17). The questionnaire assessed the status of the nursing specialist training program, including demographics and personal development. The demographic characteristics included hospital distribution, age, educational background, ICU work experience, job title, etc. Personal development contained promotion, publication, salary, the opportunity for further study, etc. This questionnaire was revised by a group of ten nurse experts. The final version was pre-tested in sixty PICU nurses, and it demonstrated satisfactory reliability and validity with a Cronbach's alpha coefficient = 0.81, KMO = 0.864, and Bartlett's spherical test $X^2 = 1469.764$ ($P < 0.001$).

3.4. Statistical Analysis

The values of means and standard deviations (SDs) for the contentious variables and the values of numbers and percentages for the categorical variables were presented by descriptive analysis. A chi-squared test was adopted to compare the group differences regarding the factors that may impact the effects of training. All the analyses were conducted by SPSS software V.13.0. The statistical significance was considered as $P < 0.05$.

4. Results

4.1. Demographic Characteristics

Among 238 PICU nursing specialists, 209 individuals agreed to participate in the survey, and the effective response rate was 87.8%. All of our participants were female, with an age range from 26 to 40 (33.28 ± 4.83) years old. They worked in 113 hospitals in China, among which 72 (63.7%) hospitals were located in Zhejiang Province. Also, 188 (90.0%) nurses were from tertiary hospitals. Furthermore, 184 (88.0%) participants had bachelor's degree, and 10 (4.8%) had a master's degree. Meanwhile, 52 (24.9%) participants were chief nurses or deputy chief nurses. Finally, 46 (22.0%) nurses had been working in ICU for 5 years, 77 (36.8%) for 6-10 years, 74 (35.4%) for 11-20 years, and 12 (5.7%) for more than 21 years.

4.2. Evaluation of the Effects of the CNS Training Program

Table 1 describes the training effects in terms of career development. Many participants launched new projects and novel technologies in their hospital after training, including peripherally inserted central catheters (PICC), ventilator-associated pneumonia (VAP) nursing intervention, enteral and parenteral nutrition support, bone marrow aspiration for infusion in emergency settings, etc. Furthermore, 54.5% of participants had published papers on peer-reviewed scientific journals, and 24.4% received grants after the training program. Also, 71.8% became head nurses, team leaders, or education secretaries with the promotion of their roles, and 39.2% became clinic teachers with a significant improvement in their teaching abilities. Meanwhile, 9.8% of participants reported an increase in their salary.

4.3. Associated Factors with the Training Effectiveness

Table 2 demonstrates the results of the chi-squared test regarding the group differences in training effectiveness across groups with different characteristics. There was no statistically significant difference in applying for new projects, publishing papers, receiving grants, and promotion across age groups, educational levels, and years of working experience in ICU ($P > 0.05$). Trainees with relatively high job titles tended to apply for the new projects in their clinical practice, publish papers, get promoted, and have an opportunity to continue their education ($P < 0.05$). The percentages of publishing papers, getting grants, and having opportunities for continuing education were significantly higher in chief nurses than in others ($P > 0.05$). Trainees who worked in tertiary hospitals reported a higher rate to conduct new projects to their work after the training program ($X^2 = 16.51, P < 0.01$).

Table 1. Application of New Projects, Publishing Papers, Receiving Grants and Promotion after the Program (n = 209).

Items	Number of Specialist Nurses (%)
Application of new projects	
Family-centered nursing care	135 (64.6)
PICC	97 (46.4)
Complete nursing evaluation	92 (44.0)
VAP nursing intervention	79 (37.8)
Enteral and parenteral nutrition support	63 (30.1)
Management of sedation and analgesia	61 (29.2)
Follow up of high-risk infants	56 (26.8)
Chest physiotherapy	48 (21.3)
Support for the development of premature infants	33 (15.8)
Intervention of pressure ulcer and iatrogenic injury	19 (9.1)
Bone marrow aspiration	9 (4.3)
Other	11 (5.3)
Publishing scientific articles (yes)	114 (54.5)
Receiving new grants (yes)	51 (24.4)
Promotion of job position	
Becoming a chief nurse	30 (14.4)
Becoming a team leader	73 (34.9)
Becoming an education secretary	7 (3.3)
Becoming a clinic teacher	82 (39.2)
Others	17 (8.1)
Salary increase (yes)	20 (9.8)

Abbreviations: PICC, peripherally inserted central catheters; VAP, ventilator-associated Pneumonia.

5. Discussion

As advanced practice nurses, CNSs play an important role in a broad set of clinical practices (18). Various countries constantly develop CNS training curricula and establish various policies to train nurse specialists vigorously (19). This study rigorously described the Chinese practice in training its CNSs with a well-designed program. We found that the training program was effective regarding improve the core competency of CNSs, particularly in terms of skills of conducting new projects, research, and teaching skills. Many trainees got a promotion and continued with education at work after the training program.

According to a recent investigation in America, about 80% of CNSs participated in nursing research, and those who had more training in the research were better at acquiring knowledge and skills (20). However, 95.8% of the subjects of this study had not published research papers as the first author, which may be explained by the design of the program with limited content regarding the method of publishing a paper. In China, the PICU nurse

Table 2. Results of Chi-squared Test Regarding the Group Differences in Training Effectiveness Across Groups of Different Characteristics

Characteristics	Applying New Projects, (Yes)			Publishing a Paper, (Yes)			Receiving a Grant, (Yes)			Promotion			Opportunity of Continuing Education		
	No. (%)	χ^2	P	No. (%)	χ^2	P	No. (%)	χ^2	P	No. (%)	χ^2	P	No. (%)	χ^2	P
Age (y)		1.52	0.47		1.91	0.38		5.20	0.07		1.23	0.54		3.26	0.2
36 -40	49 (76.5)			39 (60.9)			22 (34.3)			43 (67.1)			46 (71.9)		
31 -35	81 (70.4)			61 (53.0)			22 (19.1)			86 (74.8)			78 (67.8)		
26 -30	24 (80.0)			14 (46.7)			7 (23.3)			21 (70.0)			16 (53.3)		
Educational level		4.24	0.12		0.10	0.95		3.91	0.14		1.14	0.56		3.03	0.22
Master degree	10 (100)			5 (50.0)			4 (40.0)			7 (70.0)			7 (70.0)		
Bachelor degree	132 (71.7)			101 (54.9)			46 (25.0)			134 (72.8)			126 (68.5)		
Associate college degree	12 (80.0)			8 (53.3)			1 (6.7)			9 (60.0)			7 (46.7)		
Job title		16.06	<0.01		15.73	<0.01		5.90	0.05		8.07	0.02		11.52	<0.01
Chief nurse	47 (90.4)			39 (75.0)			18 (34.6)			43 (82.7)			42 (80.7)		
Team leader	31 (83.8)			23 (62.2)			11 (29.7)			30 (81.1)			29 (78.4)		
None	76 (63.3)			52 (43.3)			22 (18.3)			77 (64.2)			69 (57.5)		
Academic title		1.54	0.47		9.00	0.01		19.45	<0.001		1.74	0.42		11.69	<0.01
Chief nurse	9 (50.0)			10 (100)			8 (80.0)			9 (90.0)			9 (90.0)		
Nurse in charge	92 (73.6)			67 (53.6)			31 (24.8)			89 (71.2)			92 (73.6)		
Nurse	53 (71.6)			37 (50.0)			12 (16.2)			52 (70.3)			39 (52.7)		
Years of working experience at ICU		2.54	0.47		1.91	0.38		6.67	0.08				4.18	0.24	
≥ 21	10 (83.3)			39 (60.9)			6 (50.0)			9 (75.0)			10 (83.3)		
11 -20	56 (75.7)			61 (53.0)			21 (28.4)			55 (74.3)			54 (73.0)		
6 -10	58 (75.3)			14 (46.7)			16 (20.8)			60 (77.9)			48 (62.3)		
5	30 (65.2)						8 (17.4)			26 (56.5)			28 (60.9)		
Grade of the hospital		16.53	<0.01		1.840	0.61		2.14	0.54		5.43	0.14		6.96	0.07
Tertiary grade-A	113 (75.8)			85 (57.0)			39 (26.1)			108 (72.5)			105 (70.5)		
Tertiary grade-B	33 (84.6)			19 (48.7)			9 (23.0)			31 (79.5)			24 (61.5)		
Secondary grade-A	7 (38.8)			8 (44.4)			2 (11.1)			9 (50.5)			8 (44.4)		
Other	1 (33.3)			2 (66.7)			1 (33.3)			2 (66.7)			3 (100)		

specialist training program was initiated in 2010 in Zhejiang Province, and an average of 40 trainees had been enrolled every year. Through a systematic theoretical study and standard clinical practice, about 80% of the respondents reported an improvement in their specialty nursing abilities. Many of them launched new projects after returning to their hospitals. According to this survey, the teaching, research, and management skills had been improved comprehensively. For example, half of the trainees believed their teaching skills had been improved, making themselves provide better clinical training to other nurses in their workplace. All of them mastered literature retrieval and utilization skills, which laid a good foundation for paper publication and grant applications. All these results were in line with the previous research (21-23). Moreover, the research activities of CNSs in China seemed to be much higher than that in America, because more trainees published papers and participated in research programs after they finished CNS training (24). Therefore, the CNS training in China may be a promising program for improving the core competencies of nurses, which helps them become good clinical specialists, educators, consultants, researchers, innovators, leaders, and managers.

The CNS is in a key position to solve nursing problems,

and its development contributes to the theory and practice of nursing science (25). The majority of nursing questions can be solved within the evidence-based nursing practice. Thus, conducting clinical research is an important task for CNS (17). However, according to this survey, it is very difficult for nurses to apply for research projects and funds. This may be associated with the education level, training time, and previous research experience. In order to improve their capacity for clinical research, our CNS training program should increase scientific research curriculum resources. In addition, hospitals and the government should increase research funds for specialist nurses and establish a corresponding incentive mechanism to mobilize the enthusiasm and initiative of nurses to carry out scientific research, stimulate innovation, and promote continuing ICU specialist care development.

One important goal of ICU nurse specialist training is to promote new technologies and new projects in the field of pediatric intensive care in basic-level hospitals in China. After training, 73.7% of the trainees carried out various new projects when they returned to their hospitals. The present survey found that nurses working for the tertiary hospitals were more likely to carry out new projects than those from relatively low-level hospitals, which may be because those

basic-level hospitals do not have well-established PICU, or because patients enrolled in those hospitals had less severe diseases. However, trainees with positions of authority were more likely to launch new projects, as well. Since new projects require permission from the head of the department, trainees without any position of authority may meet more obstacles than chief nurses and other senior ones when promoting new techniques or projects (26). Accordingly, enrollment of students with a certain subject background (e.g., PICU professional) and a certain level of executive power (e.g., a team leader or teacher) might promote new technology projects after training. The major factors that affect the development of core clinical competencies of an individual are the title and position of the trainees, which is consistent with the previous studies (27). Trainees with management positions or similar roles performed significantly better than other ones. The following factors may contribute to their better performance: First, those with a relatively higher educational level, i.e., they had higher levels of professionalism in their writing, operation, and teaching skills. Second, those with stronger motivation to improve their competencies because most of them were leaders, and they usually supervised the other levels of nurses and led the development of disciplines. Third, due to their positions of responsibility, they can get easy access to various opportunities and resources, such as continuing education opportunities and patient resources. In order to help clinical nurses, develop their core clinical competencies, hospitals should establish appropriate incentive policies, effective support, and reasonable evaluation systems for supporting the conduction of new technology projects. However, in our survey, only 3.6% of the nurses reported that their hospitals had established systems to describe the job responsibilities and positions and to evaluate the achievement of CNSs. This ratio is exceptionally low, indicating that the responsibilities of the hospital nurses (i.e., the distribution of work and the duty of positions) are not clear. The set of full-time positions for specialized nurses and formulation of clear job responsibilities for professional nurses in specific fields would allow the development of nurse management mechanisms so that specialist nurses can reach their full professional potential (28, 29).

As we discussed above, incentive policies should be established, mainly in the aspects of title promotion, improved learning opportunities, and salary increases. However, most hospitals do not focus much on these factors. First, this survey showed that only 32% of the respondents had any opportunity to learn outside their institutions each year, which indicated that more learning opportunities should be provided for nurses following the new trend of professional development. Second, 32.4% of the respondents completing training got opportunities for promo-

tion. Third, only 9.8% of the respondents reported salary increase. All these factors would affect the enthusiasm of these individuals, and they may even lead to the losses of nurse specialists. Therefore, to further enhance working enthusiasm among CNSs, the hospitals should adjust fostering and selecting system.

5.1. Limitations of the Study

There were some limitations in this study. First, this study was an evaluation survey that reflected the post-training career development of clinical nursing specialists. We did not compare the status of participants with that of nurses who did not participate in the training to reflect the training effect of the program. Second, because this was a cross-sectional study, there was no comparison of changes in the professional competence of trained nurses before and after training. Future research should take these factors into account to fully assess the effectiveness of specialist nurse training programs.

5.2. Conclusions

The CNS training program in Zhejiang, China has improved the core competencies of PICU nurses, especially concerning clinical practice and education. The title and position of the trainees were the main factors that affected the effectiveness of the training program. The hospitals should develop incentive policies for nurse specialists, provide effective support systems, and perform regular evaluations to foster achievements among nurse specialists who completed the training.

Supplementary Material

Supplementary material(s) is available [here](#) [To read supplementary materials, please refer to the journal website and open PDF/HTML].

Footnotes

Authors' Contribution: Cangcang Fu and Nan Lin were involved in the study conceptualization and study design. Cangcang Fu and Jihua Zhu carried out the data collection and statistical analyses. Cangcang Fu, Jihua Zhu, and Nan Lin provided critical revisions of the article for important intellectual content. All the authors contributed to the interpretation of the data and approved the final version of the article.

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