Nurse anesthetist training Center on IFNA standards in Mainland China

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ABSTRACT

Aim: The first training center for nurse anesthetists in Jiangsu Province, China was established. The aim of this study is to understand the status of and effectiveness of a training program based on International Federation of Nurse Anesthetists (IFNA) standards for nurse anesthetists in China.

Background: China recently issued a clear policy to improve the quality of anesthesia care and to ensure the safety and comfort of patients. As a result, the roles of nurse anesthetists have received more attention, highlighting the importance of the development and implementation of relevant training.

Introduction: IFNA standards were applied to the development of a specialized training program for nurse anesthetists, which is expected to serve as a reference for various medical institutions and to lead to increased uniformity and improvement in the quality and efficiency of care.

Methods: These standards are divided into two indicators: curriculum and core competencies. Through questionnaires, course evaluations, and satisfaction surveys before and after the implementation of the training program, the effectiveness of the training program was analyzed.

Results: Theoretical assessment of the program was higher after its completion than before and the core competencies of nurse anesthetists significantly improved. Overall, the curriculum was highly satisfactory and important.

Discussion: Curriculum design was based on IFNA standards. Nurse anesthetists who are trained in a systematic way can work better with other professionals in providing anesthesia care. The objectives are to improve anesthesia care, reduce errors, improve physician satisfaction, and allow nurse anesthetists to realize their value. Overall, quality of anesthesia care improved after implementation of IFNA-standard training.

1. Introduction

There are currently no standardized duties or systematic training courses for nurse anesthetists (a.k.a. anesthesia specialist nurse) in China. A clear basis for training content and period of training is also lacking (Tang, 2009). This needs to be addressed to meet the goals of the "Healthy China 2030" policy. China's elderly is estimated (Ruan, 2019) to be 18% of the total population as of 2020 and this proportion is expected to grow to 31.2% by 2050, which is an increase of nearly 13%. According to a survey by the Anesthetist Branch of the Chinese Medical Association (Tang et al., 2018), the number of in-hospital surgeries in China is increasing by 10% each year. It is estimated that patients requiring anesthesia make up about 10% of the population in developed countries and will reach 80 million to 100 million in 2020. Considering the aging population, about 140 million more patients will require anesthesia. For China, anesthesia care is important as it moves towards

implementation of painless diagnosis and treatment (Horton et al., 2019).

After passing the assessments for the IFNA standards and quality of nurse anesthetists training centers, Nanjing BenQ Hospital was authorized by Nanjing Health Committee to become a nurse anesthetists training center, the first in the country to deliver training and clinical practice for nurse anesthetists in Jiangsu Province (Horton et al., 2014). Based on the CanMEDS framework (Frank and Danoff, 2007), a model for nurse anesthetists was developed. Nurse anesthetists assume the roles of professional, scholar, communicator, collaborator, manager, and health advocate. A systematic training program for nurse anesthetists was developed in stages to improve their core competencies.

1.1. Background

As early as 2005, China's "Outline of Nursing Care Development in the Eleventh Five-Year Plan" proposed the development of clinical specialist nurse training. It was not until 2018 that nurse anesthetists were considered specialist nurses and a training program was implemented for them in the hospital system. Nevertheless, China does not have uniform regulations and requirements for nurse anesthetist education. At present, education in some areas is in the form of academic education or conferences or various hospitals conduct their own training programs, resulting in uneven quality. However, the clinical demand is high and most hospitals have given nurse anesthetists anesthesia care tasks, with their main duty to assist anesthesiologists. Most of the work of nurse anesthetists takes place in the post anesthesia recovery room, and do more than such as the management of medicines and consumables. The lack of specialized nursing has led to unclear roles for nurse anesthetists and unreasonable human resource allocation (Han et al., 2020), as well as a lack of systematic training standards (Ma and Guo, 2014; Yang et al., 2020) and qualifications (Zhang and Chen, 2017; Xie et al., 2018; Tan et al., 2020).

In the recent years, the demand of Nurse Anesthetists (a.k.a. Anesthesia Specialist Nurse) is remarkably high, it is because of the aged society and demand for comfort on medical care. Therefore, the development and training of Nurse Anesthetists has become a new focus on health and pharmaceutical policies in China. There had many discussions on the educational methods and vocational training programs on Nurse Anesthetists. In 2018, China had set up the first 'Specialist Nurse Training Center', in order to train the nurse anesthetists which approved by the Nanjing Government and regarded as a matter of the utmost importance. However, the hospitals are insufficient on the professional nurse anesthesia, which means there is an urgent need to develop a professional and standardized training system, in order to provide the high-quality service and build a high-quality nursing anesthesia training center for the future need.

Both the International Council of Nurses (ICN) and the International Federation of Nurse Anesthetists (IFNA) have emphasized the training of nurse anesthetists. It is hoped that by the year 2025 nurse anesthetists in the US will have completed Doctor of Nursing Practice (DNP) programs, which shows the importance attached to their education in that country. Currently, the Approval Process for Anesthesia Programs (APAP) of IFNA is a standard anesthesia educational program (McAuliffe and Henry, 1998). The education committee of the IFNA was assigned to compile specifications, not only to develop minimum standards and best practices, but also to provide educational content that is flexible,

diverse, and suited to nurse anesthetists across the globe.

Currently, nurse anesthetist educational programs have been developed in 96 countries. Among them, the shortest is 6 months and the longest is 4 years. In the international definition of nurse anesthetists (Vera et al., 2016), certification and authorization to perform anesthesia-related care is granted after completing nursing education. Tertiary qualification in China is the completion of a three-year nursing degree after the completing of secondary school hereunder we refer as 'Junior College'[2].

1.2. Aims

The goal of nurse anesthetist educational programs is to ensure that patients are provided with complete and safe anesthesia care. Only nursing staff who have completed an anesthesia care course and anesthesia care teachers who are involved in supervising students are eligible to perform or participate in anesthesia care. Few studies in China have explored the effectiveness of training courses on the core competencies of nurse anesthetists. Cultivation of nurse anesthetists in the US is done through the higher education system, mainly at the Master's and doctoral levels, while that in China focuses on different forms of training. Therefore, the aim of this study is to investigate the effectiveness of IFNA-standard training program for nurse anesthetists in China.

2. Methods

2.1. Design and setting

Nine major nurse anesthetist core competency courses (Herion et al., 2019) (a total of three years, 1175 h) were developed. Content included anatomy, physiology and pathology (2.98%); clinical course (7.23%); clinical practice (62.98%); anesthesia equipment and monitoring (3.57%); clinical pharmacology of anesthesia (3.83%); health assessment and education (0.68%); basic principles of anesthesia (6.81%); introduction to organization and systems (1.70%); and research and theoretical integration (10.21%) (Table 1). From a survey conducted in 2018, the training of nurse anesthetists in various operations improved, as did theoretical assessment, core competencies, and satisfaction. Continuous and gradual educational development can meet the requirements of nurse anesthetists, avoid risks during anesthesia, and improve the professional development of nurse anesthetists (Li and Hu, 2015; Yu and Zhao, 2018).

Table 1
Major nurse anesthetist training courses.

Number	Course items	Hours	Percentage%
1	Anatomy, physiology and pathology	35	2.98
2	Clinical practice	740	62.98
3	Clinical course	85	7.23
4	Anesthesia equipment and monitoring	42	3.57
5	Clinical pharmacology of anesthesia	45	3.83
6	Health assessment and education	8	0.68
7	Basic principles of anesthesia	80	6.81
8	Organization and system introduction	20	1.70
9	Research and theoretical integration	120	10.21
		1175	100

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[2] There are three different ways to acquire an undergraduate degree: the first one is by entering national Self-taught higher education examinations after graduation from junior college, with completion of the prerequisite courses/credits stipulated by different university to obtain an undergraduate degree; the second one is to complete a five-year nursing degree after graduating from high school. The third option is through the completion of the unified national Adult Higher Education.

2.2. Research subjects and site

This is a correlational study of subjects before and after completing training courses. Individuals who completed the training program in the case hospital were the subjects. They evaluated the courses and teachers by filling out questionnaires. This study was approved by the medical ethics committee of the receiving institution (No. 2020KL001-01) and subjects were enrolled after signing an informed consent form. Enrolled subjects met the following criteria: 1. Graduated from a university nursing department, 2. Had a passion for working as a nurse anesthetist, 3. Passed the examination on theories and skills required of nurse anesthetists, 4. Trained as nurse anesthetist for more than 18 months, with nursing qualification certificate or diploma, and completed training for newcomers to the hospital and anesthesia department. From 2011 to 2018, 39 subjects were enrolled.

2.3. Research tools and reliability

Demographic information included gender, education, rank, years of work experience, experience as nurse anesthetist outside of the hospital, current job scope, first aid license, whether or not there was agreement with the role of nurse anesthetists, recognition of the job description of nurse anesthetists, and recognition of core competencies. Two types of methods for assessing the professional competencies of nurse anesthetists were used, rank and course assessment. Integrating the Cowin et al. (2008) philosophy, nurses were divided into 15 ranks, NA1-1 ~ 1-3, NA2-1 ~ 2-4, NA3-1 ~ 3-4, and NA4-1 ~ 4-3. There were two promotion standards. The first included grades, ranks, practicing certificates, basic treatment theory, academic qualifications, case hospital seniority, total course attendance hours, training in acute and critical units, quality control participation, work improvement, and scientific research papers. The second included theory, teaching ability, annual assessment, administrative ability, and extracurricular learning.

Course evaluation was implemented via self-made scales, consisting of two parts and 34 questions. The first covered the overall arrangement and design of the training course (5 questions) and the teaching quality (12 questions). The second included evaluation by subjects (8 questions) and curriculum teaching evaluation (9 questions). These scales were used to investigate importance and satisfaction and to highlight areas for improvement and of concern. The evaluated items included attention and satisfaction, and were scored on a LIKERT five-point scale (Very important 5. Somewhat important 4. Average 3. Not very important 2. Not important at all 1.; Very satisfied 5. Somewhat satisfied 4. Average 3. Somewhat dissatisfied 2. Very dissatisfied 1). With this method, participants' thoughts on the design of the training course content or educational plan were obtained. There was good reliability and validity, with Cronbach's alpha (r) for each scale between 0.87 and 0.95 (Supplemental Tables 1, 2, 3, and 4).

2.4. Data analysis

SPSS for SAS 9.4 (Cary, NC: SAS Institute. Inc. SAS® 9.4) computer statistical software was used for data input and analysis. Demographic data of the nurse anesthetists who underwent training is presented as numbers (percentages). Total scores of four large tables were calculated for course evaluation, including the training course as a whole, such as the arrangement and design (5–25 points), teaching quality (12–60 points), self-assessment (8–40 points), and curriculum teaching evaluation (9– 45 points). Spearman correlation coefficient was used to evaluate the correlations between each index and satisfaction. The paired *t*-test was used to check for significant differences in pre-test and post-test scores. Criteria for promotion are shown, in addition to academic and clinical performances, with descriptive data provided. Two-tailed test was used for comparisons with significance set at *p*-value of 0.05.

3. Results

3.1. Demographic characteristics of subjects

Of the 39 participants, 94.87% were women, 74.36% had a college degree, (one of the criteria for "inclusion" is the university degree in nursing which is different in China in terms of School system). When we fill out the application form, we have separated applicants with their different academic degrees. Among the thirty-nine applicants, 74.36% of the applicants graduated with a four-year undergraduate degree in nursing and 23.08% got their degree through the two year Junior college + two year university), and most had more than 8 years (35.9%) or 5–8 years (33.3%) of work experience. About 58.97% had no work experience as a nurse anesthetist before joining the anesthesia department. Some of the existing staff members (35.90%) had completed the training program and were working in other hospitals. All participants agreed with the job description of nurse anesthetists (Table 2).

3.2. Feedback from nurse anesthetists on course evaluation

In terms of course evaluation, the overall arrangement and design of training courses was assigned an average score of 22.41 (SD = 2.73) and a satisfaction score of 20.30 (SD = 2.56) (Table 3). These results revealed the relationship between the importance of design and satisfaction (Spearman $r = 0.355$, $p = 0.0262$), Fig. 1(a). Regarding teaching importance, the total score was 52.84 (SD = 6.67) and the satisfaction score was 50.23 (SD = 6.60). Teaching importance was related to satisfaction (Spearman $r = 0.553$, $p = .0003$), Fig. 1(b). The average

Table 2
Characteristics of study sample, $n = 39$.

Characteristics	N
Gender	
Female	37 (94.87%)
Male	2 (5.13%)
Education	
Institute	9 (23.08%)
College graduate	29 (74.36%)
Postgraduate	1 (2.56%)
Job title	
Licensed practical nurse	1 (2.56%)
Registered nurse[a]	23 (58.97%)
Supervisor	15 (38.46%)
Years of anesthesia experience	
Under 3 years	8 (20.51%)
3–5 years	4 (10.26%)
5–8 years	13 (33.33%)
Over 8 years	14 (35.90%)
Other hospital anesthesia care experience	
No	23 (58.97%)
Yes	2 (5.13%)
Working in other hospitals	14 (35.90%)
Scope of work (multiple choice)	
Material management	15 (38.46%)
PACU care	37 (94.87%)
Operating room	31 (79.49%)
Recovery room	24 (61.54%)
Outpatient anesthesia	7 (17.95%)
License (multiple choice)	
ACLS	5 (12.82%)
BLS	28 (71.79%)
Identifies as nurse anesthetist	39 (100.00%)
If could choose again, would still work as a nurse anesthetist	35 (89.74%)
Understands IFNA educational philosophy	34 (87.18%)

[a] Here they stipulated the three different levels of nurse profession in China, Licensed practical nurse, Registered nurse and Supervisor. All them those are Registered Nurses. Maybe there were some problems in translation which led to the miss-understanding. We hereby amend the translation.

Table 3

Nurse anesthetists on course evaluation.

Evaluated items	R	p	Value			Satisfaction		
			Mean	SD	MAX	Mean	SD	MAX
Classroom arrangement and design	0.355	0.0262	22.41	2.73	25.00	20.41	2.56	25.00
Instructor's explanation and demonstrations	0.553	0.0003	52.84	6.67	60.00	50.23	6.60	60.00
Improvement in clinical practice	0.707	0.0001	36.69	3.92	40.00	35.97	4.53	40.00
Teaching materials	0.830	0.0001	40.15	4.94	45.00	40.00	5.48	45.00

(a) Classroom arrangement and design

(b) Instructor's explanations and demonstrations

(c) Improvement in clinical practice
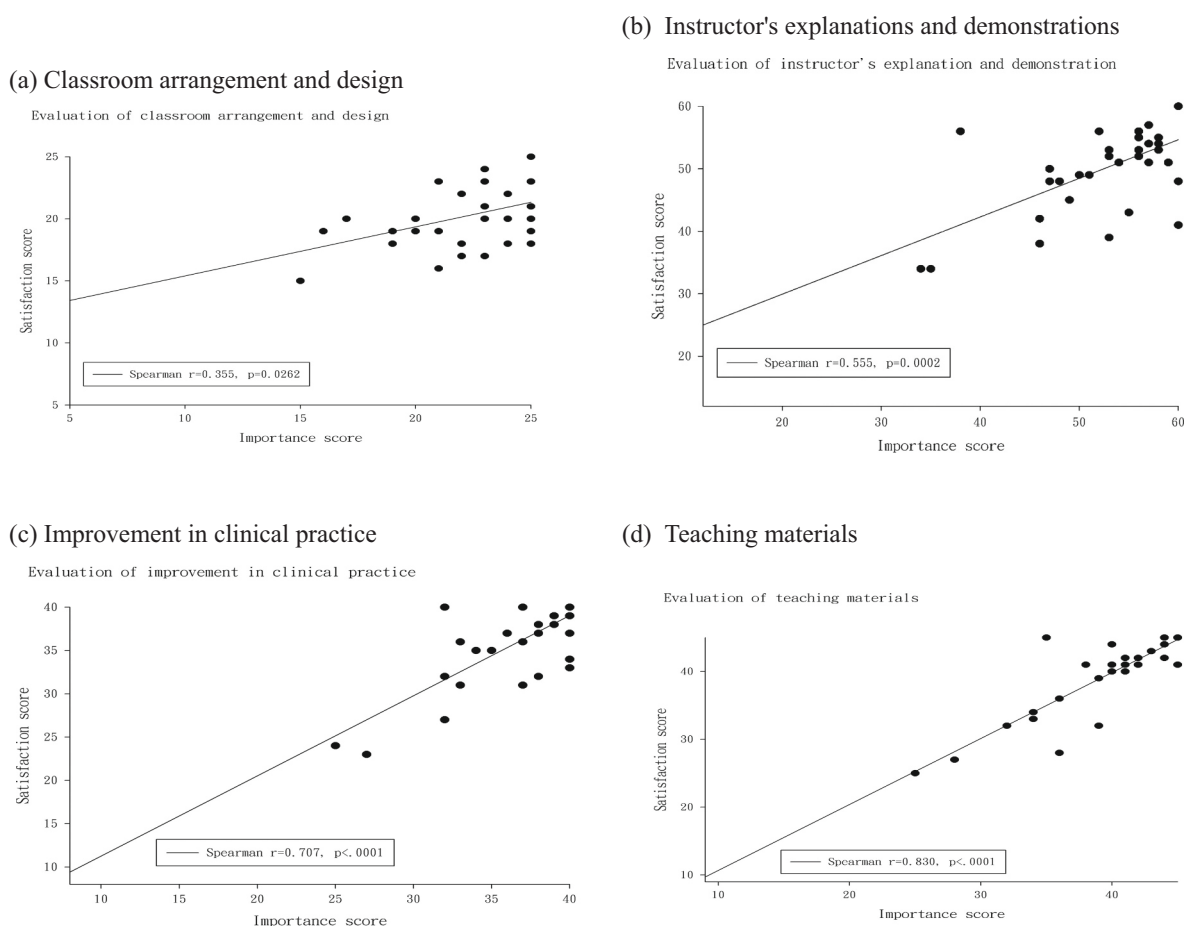
(d) Teaching materials

Fig. 1. Overall training course evaluation and effectiveness feedback, scatter plots of relevance to total satisfaction score and correlation.
a. Classroom arrangement and design.
b. Instructor's explanations and demonstrations.
c. Improvement in clinical practice.
d. Teaching materials.

value for curriculum practicality was 36.69 (SD = 3.92) and the total satisfaction score was 35.97 (SD = 4.53) (Spearman $r = 0.707$, $p <$ .0001), Fig. 1(c). The average value of training course content was 40.15 (SD = 4.94) and the total satisfaction score was 40.00 (SD = 5.48). This indicates that the importance of training course content is related to satisfaction (Spearman $r = 0.830$, $p <$ .0001), Fig. 1(d).

3.3. Results of training and evaluation of nurse anesthetists

In addition to traditional theoretical and operational assessments, a comprehensive core competency assessment was applied. In each stage, different core competency assessment methods were used according to the main points of the training and divided into stages: anesthesia combined care; recovery room care; independent duty and critical patient care; and basic nursing operation. Through phased comprehensive

training and assessment methods, the core competencies of nurse anesthetists significantly improved. The theory and practice of continuing education were evaluated 8 times before and after training. There were significant differences in the assessments before and after training ($p <$ .0001), as shown in Table 4.

4. Discussion

Based on IFNA standards, a curriculum that addresses core competencies was developed. Core competencies, role positioning, and effectiveness of the training program were analyzed, including the teaching methods and the ability to apply the results of training. Breaking through conventional teaching modes, a training course suited to the development of nurse anesthetists in domestic hospitals was developed. The aims were to improve the professional competencies of nurse

Table 4
Average score of assessment before and after course.

	Before course		After course		Change after course	
	Mean	MAX	Mean	MAX	Mean (SD)	*p* value
Phase one						
Cooperative general anesthesia	70.16	80.00	88.96	100.00	18.80 (6.58)	<0.0001
Cooperative spinal anesthesia	71.92	80.00	88.24	96.00	16.32 (5.52)	<0.0001
Phase two						
Post-anesthesia care & critical cate	72.40	85.00	90.00	100.00	17.60 (6.58)	<0.0001
Keeping equipment warm	68.00	90.00	88.80	100.00	20.80 (5.71)	<0.0001
Phase three						
Airway management	70.32	82.00	87.96	98.00	17.64 (7.26)	<0.0001
ACLS (Advanced Cardiac Life Support)	71.40	85.00	90.40	100.00	19.00 (6.92)	<0.0001
Phase four						
Infection control	69.60	85.00	87.80	100.00	18.20 (4.97)	<0.0001
Autologous blood transfusion system	72.24	80.00	88.64	96.00	16.40 (6.32)	<0.0001

anesthetists and to clarify their responsibilities, which is conducive to promoting cooperation and collaboration among anesthesia care teams. Due to the development of a systematic training system in BenQ hospitals, the quality of teaching and management of anesthesia has improved significantly, the incidence of adverse events has decreased significantly, and physician satisfaction and patient satisfaction have increased (Dexter et al., 2017; Yu et al., 2018). The nurse anesthetist's value has been realized, with increasing enthusiasm for and identification with the work, as well as improved medical care quality and services. The results of this study provide a reference for the development of a systemic nurse anesthetist training program and training centers in China.

5. Conclusion

After nearly 10 years of development of a training program, nurse anesthetists have achieved good results in clinical training. Combining education with the continuous development of medical technology and increase in demand for medical services and adapting nursing technology and services to new clinical needs have become important topics. In addition, most nurse anesthetists are not yet sufficiently trained (Hu et al., 2017), with specialist nurses just meeting the basic requirements (Lv et al., 2019). To provide high-quality anesthesia care services for patients, a nurse anesthetist training system is needed (Fang and He, 2012). With a high-level of professional talent and by taking patient safety and comfort into account and health care as a responsibility, the professional value of nurse anesthetists can be realized (Sun et al., 2017; Zhang et al., 2020). This study was based on the analysis of the difference between the emphasis, expectations and satisfaction evaluation of the trainees, in order to evaluate the effectiveness of the Nurse Anesthetist Training Center in China. This method can effectively reflect that whether there have differences between the training center and the actual situation. This research can be seen as a guideline for the training center on Nurse Anesthesia, it has an instructive purpose on establishment of a systemic training program, to provide a valuable reference of the nurse anesthesia training center in the future.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.nedt.2021.104775.

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