Evaluation of the Effect of Pre-Job Training on New Pediatric Nurses Based on Onion Model

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Zeng et al.: Pre-Job Training effect on Nurses Based on Onion Model

To determine the effect of pre job training on onion model among new pediatric nurses. One hundred and seventeen pediatric nurses that commenced work on July 1, 2019 after 2 w of conventional training and 94 nurses that received the onion mode of training for 2 w before July 1, 2020 were recruited as the control and experimental groups respectively. The theoretical, practical and training quality scores of the new nurses were compared. The experimental group had significantly higher theoretical score (78.53±4.96 *vs* 69.27±11.38), Cardiopulmonary resuscitation score (92.39±4.06 *vs* 91.38±3.12), intradermal injection score (94.97±3.16 *vs* 92.35±3.96) and training quality evaluation score (99.07±4.5 *vs* 97.27±7.51) compared to that of the control group (p<0.05 for all). The onion training model can improve the theoretical and practical skills of new nurses and the quality of pre-job training.

Key words: Onion model, pediatrics, new nurses, pre-job training

Pre-job training enables new nurses to adapt to their job and ensure quality service and patient safety. According to the requirements of the Training outline for new nurses (Trial) (hereafter referred to as the Outline)[1] formulated by the General Office of the National Health and Family Planning Commission in 2016, all medical institutions are required to conduct the pre-job training of new nurses. The training of new pediatric nurses in China mainly focuses on the development and hierarchical training of intensive care specialist nurses[2,3], which can often increase psychological pressure and hinder their professional development[4-6]. Therefore, it is necessary to explore a training mode suitable for the pre-job training of new pediatric nurses. The onion model (fig. 1), a modified of the iceberg model devised by Spence et al.[7], consists of three layers. The outer layer comprises of basic theoretical knowledge and skills that are easy to master and can be improved through training. The middle level metaphorical ability is the ability of nurses to be competent for clinical work. Finally, the innermost or core layer consists of professional accomplishments and competency that can only be achieved after several years of clinical practice and all-round training. We applied the onion model to the pre-job training of new nurses along with the current training regimen in our country[8] and the characteristics of maternal and child specialty in our hospital, and achieved good results. The specific implementation report is described in this paper.

MATERIALS AND METHODS

General information:

One hundred and seventeen pediatric nurses that commenced work on July 1, 2019 after 2 w of conventional training and 94 nurses that received the onion mode of training for 2 w before July 1, 2020 were recruited as the control and experimental groups respectively. The inclusion criteria were as follows: completed the nurse qualification examination or obtained the nurse qualification certificate, obtained a college or bachelor's degree or above diploma, voluntary participation and willingness to provide informed consent. The nurses that obtained the graduation certificate of standardized training at our hospital or failed to pass the probation period for various reasons after joining the job were excluded. There was no significant significance between both groups in terms of general data (p>0.05; Table 1).
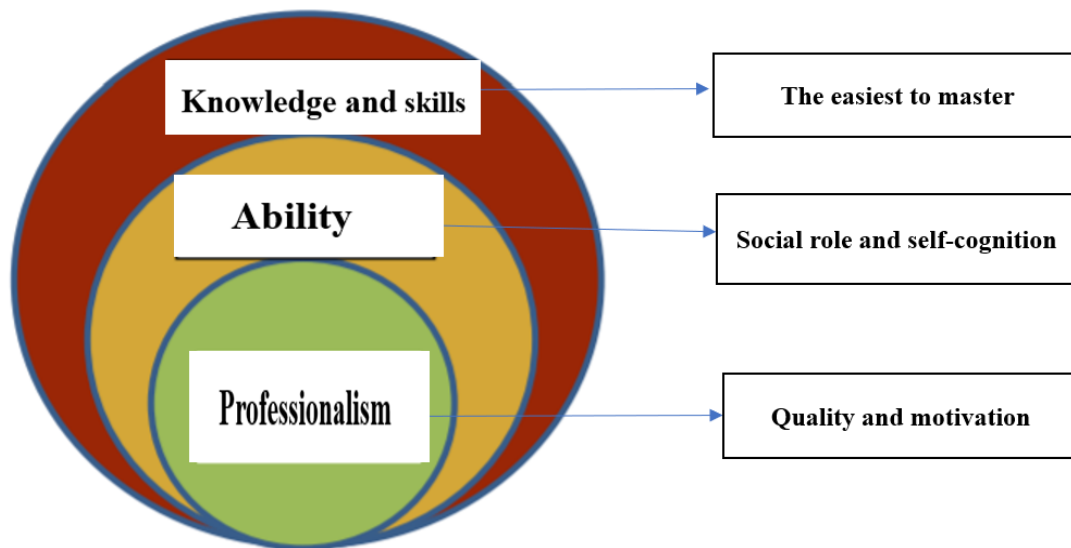
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Fig. 1: Onion Model

TABLE 1: BASIC INFORMATION OF RESEARCH OBJECTS

Project	2019 (n=117)	2020 (n=94)	T/x²	p
Age (y)	23.92 ± 1. 46	23.72 ± 1. 41	1.004	0.317
Sex [Example (%)]			2.280 a	0.131
Male	18 (15.4%)	8 (8.5%)		
Female	99 (84.6%)	86 (91.5%)		
Education [Example (%)]			2.799 a	0.247
Graduate student	8 (6.8%)	4 (4.3%)		
Undergraduate	76 (65.0%)	71 (75.5%)		
Junior college	33 (28.2%)	19 (20.2%)		
Have any working experience [example (%)]			0.008 a	0.929
Yes	53 (45.3%)	42 (44.7%)		
No	64 (54.7%)	52 (55.3%)		

Methods:

As required by the outline, the control group received conventional pre-job training for 2 w regarding hospital-related culture, theoretical concepts, system, safety etc. After the training is completed, each department will return to the department for 2 w of clinical pre-job training according to the situation of the department. The training content covers the relevant system, theoretical knowledge and operation skills of pediatric nurses. After the training, the nursing department will uniformly complete the evaluation of theoretical knowledge, operation skills and teaching quality. The experimental group additionally received the pediatric centralized 2 w pre-job training by the head nurse. The training plan and power point presentation (PPT) courseware for training were developed and reviewed by the head nurse of the department. A nurse with training management experience is the head teacher, who is responsible for assisting in training related

work. The head nurse of the department supervises and the head nurse of each department is responsible for the system. The personnel responsible for training and assessment are the head nurse and Educator of each department.

Implementation of onion model training: Requirements for teachers: The teachers had to fulfill the following requirements: Train the Trainer (TTT) training teacher certificate from our hospital, qualification certificate of university teachers, Bachelor's degree or above, more than 5 y of teaching experience, published one or more papers in statistical sources and above journals within 3 y and at least one teaching article every year. The qualified individuals either applied personally or were recommended by the respective departments. The nursing department and the pediatric teaching and research section shall organize a unified competition, giving

priority to the selection of head nurses and Educators in pediatric wards. The training team consisted of 31 teachers aged 28-37 y from 9 pediatric sub-professional departments, including 18 master nurses, 13 undergraduate nurses, 2 deputy director nurses, 18 supervisor nurses and 11 nurses. The clinical and teaching experience ranged from 5-15 y.

Training Objectives: The objectives of the training program were as follows:

Knowledge-Basic and specialized pediatric knowledge and skills, professional-related information, basic first aid and emergency response, rules and regulations, hospital infection prevention and control etc.

Skills-Practical applications of basic and specialized nursing techniques in pediatrics, operating the information system, operating common clinical equipment, first aid skills etc. Ability: general disease assessment ability, inter-personal communication etc.;

Professional accomplishment-Guiding new nurses to establish professional goals, formulating 3 y plans, maintaining professional behavior and ethics etc.

Contents of training: The training program was devised on the basic framework of core competency of general nurses proposed by the International Association of Nurses (ICN)[9], the Core Competence Standard for Nurses[10] formulated by the Australian Association of Nurses and Midwives (ANMC) and the Core Competence Framework for Chinese Registered Nurses constructed by Liu Ming *et al.*[11], along with the onion model (Table 2).

Training duration: The training plan was drawn up two mo in advance. The head nurse of each ward leads the teaching team to be responsible for the teaching of the system diseases where each department is located and draws up the training plan. The first week of training consisted of theoretical concepts from Monday to Friday and a test was conducted on Friday afternoon. The final results were included in the performance appraisal. The second week of training includes return to each nursing unit to enter clinical operation and

TABLE 2: SORTING OUT THE TRAINING CONTENTS OF "ONION MODEL" FOR NEW NURSES

Level I Indicators	Secondary index	Training content
Knowledge	Basic knowledge and theory	Basic medical knowledge and basic theory of common diseases; Basic nursing knowledge and basic theory of common diseases; knowledge of commonly used drugs; General inspection knowledge
	Specialist knowledge	Specialized medical knowledge of common diseases; Specialized nursing knowledge
	Professional related knowledge	Nursing humanities; Sociological knowledge
	First aid and emergency	Knowledge of commonly used first aid drugs; Emergency nursing evaluation and emergency nursing measures; Emergency Plan for Common Accidents
	Rules and regulations	Nursing related laws and regulations; post responsibilities of nursing staff; Clinical nursing system; Training and assessment system; Operating technical specifications; Document Writing Specification
	Hospital sense prevention and control	Hand hygiene (timing, method); aseptic technique; cleaning and disinfection; Occupational protection and treatment of medical personnel; Classification of medical wastes
Skills	Operational Skills	Basic nursing technique operation; Specialized nursing technique operation; the general operation of the information system; Operation of common clinical equipment
	First aid skills	Common first aid techniques; Use of common emergency equipment
Ability	Professional practical ability	General disease assessment ability
	Clinical thinking ability	Critical thinking ability
	Communication and coordination ability	Nursing interpersonal communication
	Career development ability	Career Exploration Stage-Establishing Career Goals
Professional accomplishment	Professional image	The Basic Concept of Nurses' Professional Image and Etiquette
	Professional emotion	Professional identity
	Professional ethics	Moral Cultivation Reflected by Nurses in Their Work

self-study content learning and examination. The entire plan is outlined in Table 3.

Centralized training: The basic operation adopts theoretical explanation and recording operation video. All theoretical teaching adopts simultaneous playing on and off the nail line[12] and playback function, which is convenient for students to review and establish teaching resource database. The training takes the form of flip class, scenario simulation, classroom teaching, operation drills, etc. The training plan is issued 2 w before the training. All the contents of training have pre-class thinking questions and homework after the class. Students are required to preview the training content and search for novelty materials in advance in combination with the pre-class thinking questions. Among these hours, 38 h of theoretical teaching and 40 h of clinical practice.

Training Implementation and Requirements: A WeChat training group for new pediatric nurses was set up, which also included the head nurses and teachers of each department, to facilitate information exchange. Requirements for full-time theoretical training: Thinking questions and homework before class should be sent to WeChat Group of new nurses 3 d in advance, and questions and spot checks should be carried out during training. The daily thinking questions shall not be less than 3-5, and the content shall include all the topics of the training on that day. Theoretical tests will

TABLE 3: PRE-JOB TRANIING WEEK PLAN FOR NEW NURSES

Number of weeks	Course responsible department	Specific training content
	tt	
Monday	Pediatric Teaching and Research Section (Morning) Pediatric Infection Division (Afternoon)	1. Safety knowledge: (1) Pediatric nursing adverse event cases and warning education (medical adverse events); (2) Interpretation of ten safety objectives. 2. Operation: Intravenous dosing. 1. Hospital sense knowledge: (1) Prevention and control of hospital infection outbreaks; (2) Prevention and control of multi-drug resistant bacteria infection; (3) Hospital infection and medical supplies/expiration period management. 2. Operation: Isolation gown.
Tuesday	Child Health Section (Morning) Pediatric PICU (Morning) Pediatric Nephrology (PM)	1. Basic knowledge: (1) Evaluation of children's physical development and growth and development rules; (2) Reasonable feeding of normal children and nutritional needs of children; (3) Application of disease assessment framework in PICU; (4) Early identification and treatment of critical and severe children. 2. Operation: Indwelling needle puncture. 1. Theoretical knowledge: (1) Anatomical and physiological characteristics of children's genitourinary system and evaluation and nursing of common diseases of urinary system; (2) Evaluation of electrolyte disturbance in children; (3) Glucocorticoid is safe to use.
Wednesday	Pediatric Hematology Department (Morning) Pediatric Cardiovascular (Afternoon)	1. Theoretical knowledge: (1) Anatomical and physiological characteristics of children's blood system and evaluation and nursing of common diseases of blood system; (2) Types of blood products and blood transfusion safety; (3) PICC maintenance and prevention and treatment of complications in children. 2. Operation: Intravenous blood transfusion 1. Specialist knowledge: (1) Anatomical and physiological characteristics of children's circulatory system and assessment and nursing of common diseases; (2) Safety of cardiovascular medication in children. 2. Operation: Subcutaneous and intramuscular injection.
Thursday	Pediatric Respiratory Department (Morning) Digestive Endocrinology Division (PM)	1. Basic knowledge: (1) Anatomical and physiological characteristics of children's respiratory tract and assessment and nursing of common respiratory diseases; (2) Assessment of vital signs of children (of all ages); (3) Precautions for children's atomization. 2. Operation: Suction of sputum and oxygen. 1. Basic knowledge: (1) Anatomical characteristics of children's digestive system and assessment and nursing of common diseases of digestive system; (2) Blood sugar assessment and monitoring, safe use of insulin. 2. Operation: Gastric tube and enema.
Friday	Pediatric Neurology (Morning) Pediatric Teaching and Research Section (Afternoon)	1. Theoretical knowledge: (1) Anatomical characteristics of children's nervous system and assessment and nursing of common diseases; (2) Safe application of high-risk leakage drugs and high warning drugs. 2. Operation: Oral administration. 1. Completion Theory Examination: Single Choice, Multiple Choice, Judgment, Case Analysis; Operation examination: unified examination by nursing department. 2. Training summary and feedback survey shall be completed within 3 days after the theoretical examination.

be conducted at the end of the 2 w full-time training and relevant departments will make preparations in advance. Requirements for clinical operation and self-study: After entering the departments in groups, the head nurse and teacher of each department shall be responsible for the practical training, spot check and assessment of self-study contents. The homework assigned on the training day shall be submitted within a time limit. Relevant requirements for examination: the teacher is responsible for the examination of questions, the head nurse is the supervisor and the head nurse of the department will examine the questions bank and PPT within the specified time after they are completed.

Effect Evaluation: The theoretical test paper covered the contents of basic system, basic theory, hospital infection and other aspects. It consisted of 40 multiple choice questions with 1 point scored for each correctly answered item, 10 multiple-choice questions with 2 points scored for each item, and 20 yes/no questions with 1.5 points scored for each item. The reason for the wrong choice should be explained. The total score of the test was 100 points and 60 points and above was considered qualified. All questions are assessed on the satellite line. The examines had 100 minutes to finish the test with only one chance to answer each question, and the paper was submitted automatically once the time elapsed.

Practical assessment: The practical test consisted of Cardiopulmonary resuscitation (CPR), intradermal injection and intravenous infusion based on the "Assessment Standard for Operation Training of New Nurses" compiled by our hospital. The total score of the test was 100 points and at least 90 points were required for passing.

Training quality evaluation: The training quality was evaluated on the basis of literature reports[13,14] and the "Training Quality Evaluation Scale for New Pediatric Nurses" from the "New Nurses Training Outline". The questionnaire includes a total of 20 items across 6 parts including training preparation, goal, process, method, summary and effect, and is scored on the basis of the Likert 5 scale ranging from 1 (very dissatisfied) to 5 (very satisfied) points. The total score of the scale is 100 points and higher scores indicate greater satisfaction with the training quality. The questionnaire was devised after consulting with eight clinical nursing, nursing teaching and nursing scientific research experts from our hospital. The I-CVI of each item in the questionnaire was greater than 0.89 and the average S-CVI

was 0.88. At the completion of each lecture, the head teacher issued the two-dimensional code to the new nurses to complete the evaluation of the trainer.

Statistical analysis

SPSS 23.0 was used for all statistical analysis. The measurement data was expressed as $x \pm s$ and compared by t test. The counting data was expressed in terms of numbers and percentages, and compared by the chi-square test. $p < 0.05$ was considered statistically significant. The scores of the theoretical and practical tests of the two groups of new nurses trained under different modes are compared in Table 4. The evaluation of training quality is compared in Table 5.

RESULTS AND DISCUSSION

The average score of the theoretical examination was significantly higher for the experimental group compared to the control group (78.53 ± 4.96 vs 69.27 ± 11.38; $p < 0.01$). The CPR score of the experimental group was 92.39 ± 4.06 compared to 91.38 ± 3.12 in the control group ($p < 0.05$). Furthermore, the experimental group also scored higher than the control group in terms of intradermal injection (94.97 ± 3.16 vs 92.35 ± 3.96; $p < 0.01$). However, the intravenous infusion score was similar for both groups (control 91.54 ± 4.69 vs experimental 90.41 ± 3.98; $p > 0.05$), which is likely due to the fact that intravenous infusion is a basic nursing skill and relatively simple. Thus, the onion model significantly improved the theoretical, CPR and intradermal injection scores of new nurses, which is consistent with the findings of Zhang Fengqin et al.[15]. Nursing experts focus on the ability of new nurses to incorporate theory into practice using real clinical cases as the background, and gradually build their critical thinking skills[16]. The onion model integrates pediatrics nursing concepts through flip class, scene simulation, classroom teaching, operation drills, and videos of real clinical scenarios.

The training quality evaluation score of the control group was 97.27 ± 7.51 points compared to the significantly higher 99.07 ± 4.5 in the experimental group ($p < 0.01$). There were significant differences in training preparation, process, methods, summary and effect between the two groups ($p < 0.01$), whereas the training objectives were similar ($p > 0.05$). Thus, the training objectives for new pediatric nurses in our hospital were clear and consistent with the requirements of the Outline. In terms of class content, the experimental group responded to the teacher's PPT, the teaching

TABLE 4: COMPARISON OF THEORETICAL AND OPERATIONAL AND OPERATIONAL ASSESSMENT RESULTS

Time (y)	Number (Person)	Theoretical examination (points)	Operation Assessment (Points)		
			CPR	Intravenous infusion	Intradermal injection
2019	117	69.27 ± 11. 38	91.38 ± 3. 12	91.54 ± 4.69	92.35 ± 3. 96
2020	94	78.53 ± 4. 96	92.39 ± 4. 06	90.41 ± 3. 98	94.97 ± 3. 16
	T	7.944	1.991	-1.855	-5.347
	P	0.000	0.048	0.065	0.000

TABLE 5: COMPARISON OF TRAINING QUALITY EVALUATION

Time	Person-times	Training preparation	Training Objectives	Training process	Training methods	Training Summary	Training Effect	Total Score
2019	330	9.66 ± 0.72	9.75 ± 2. 25	38.63 ± 3. 14	19.62 ± 1. 17	9.76 ± 0.67	9.74 ± 0. 68	97.27 ± 7. 51
2020	305	9.90 ± 0.47	9.92 ± 0. 53	39.61 ± 1. 98	19.84 ± 0. 85	9.86 ± 0.51	9.91 ± 0.48	99.07 ± 4. 50
T		-5.173	-1.23	-4.736	-2.750	-2.586	-3.565	-3.693
P		0.000	0.20	0.000	0.006	0.010	0.000	0.000

content was closely linked to the teaching materials, and the clinical and practical concepts were combined. The teaching methods are various, and proper use of questioning, interaction, model and other methods to assist teaching can better embody constructivism in the teaching process. With students as the center, new nurses can better understand and master the teaching contents and guide the construction of their clinical thinking ability. The training quality of new nurses is very important to the growth of new nurses. In the onion training model, each department prepared the teaching content 2 mo in advance, and the head nurse repeatedly reviewed and modified the PPT content of each department following discussion with the head nurses and teachers. In the classroom teaching process, the teaching teachers are fully prepared in class, PPT is well made, the content is strictly implemented in accordance with the training plan, and the teaching process is serious and rigorous. Each teacher uses his own teaching methods and combines with clinical actual cases to provide the students with the best quality classroom content, so that the students can gain more as much as possible. At the same time, from the cost-benefit aspect of pediatric training, collective training has saved the training labor cost to a certain extent and laid a foundation for the establishment of pediatric training knowledge base.

The onion model significantly improved the theoretical and practical skills of new nurses, as well as the training quality evaluation, compared to the traditional training mode. Nevertheless, the training content and curriculum need to be further optimized. In addition, the sample size of this study was small, which may have introduced a bias.

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