Nursing innovation workshop to improve clinical nurses' innovation ability and research ability: A quasi-experimental study

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Abstract

Background: The current innovation and research ability of nurses in China is at a low to medium level. Most studies focus on nurses' innovation and research ability and the associated influencing factors, while few interventional studies have considered how to improve nurses' innovation and research ability. The aim of the study is to explore the effects of nursing innovation workshops in improving clinical nurses' innovation and research ability.

Methods: This quasi-experimental study was conducted in a tertiary hospital of Guangdong. Thirty-seven recruited nurses participated in a nursing innovation workshop for half a year. Questionnaire data on nurses' self-rated innovation ability and research ability were collected before the training and 3 months after finishing the training.

Results: Nurses' self-rated innovation ability ($P < 0.001$, 95% confidence interval 12.79 to 15.05) and research ability ($P < 0.001$, 95% confidence interval 14.39 to 19.09) improved significantly after the training.

Conclusions: Nursing innovation workshops represent an effective and feasible teaching method that can promote innovative thinking and improve the innovative ability and research ability of nurses.

Background

In response to the rapid development and progress of science and technology, hospitals have promoted healthcare innovations to develop highly efficient and economical patient-centred care environments (1). As a key force in healthcare services, nurses must constantly innovate to keep pace with the health industry and improve the quality of care (2). Innovation is "the design, invention, development, and/or implementation of new or altered products, services, systems, organizational structures, or business models for the purpose of creating new value for customers and financial returns for the firm" (3). The American Nurses Association (ANA) defined nursing innovations as implementing new thoughts or existing ideas in the practice of new methods (3). The ANA noted that solving the complex problems of clinical practice requires innovative solutions and methods. Yan et al. (4) defined nurses' innovation ability as the ability to actively seek and develop new methods, new technologies and new tools to promote health, prevent diseases, improve the quality of care of patients, and apply innovation to work through teamwork and reasonable support channels. This study adopts this definition, which includes four elements: innovation subject, innovation process, innovation environment and pressure and innovative products (4).

In most health systems across the world, nurses provide up to 80% of primary health care (5). Nurses are critical thinkers on the front lines of care delivery who often innovate by identifying more efficient processes or repurposing items for alternate uses; they are therefore uniquely positioned to improve clinical practice through such ideas (6, 7). Fostering innovative nursing ability could improve medical service quality, increase job productivity, improve the effectiveness of treatment, reduce healthcare costs while satisfying the needs of patients, improve the effectiveness of care services, improve access to healthcare services and simplify the process involved in delivering such services (1, 8-11).

However, the level of innovation ability of nurses in China and abroad differs. Polster et al. (12) investigated 217 clinically registered nurses from a midwestern urban Magnet teaching hospital with 408 beds in Chicago, United States and found that 90.3% had good innovative ability. However, Stilgenbauer et al. (13) conducted a survey in the American Organization of Nurse Executives newsletter, and it was graded using the Scales for Measurement of Innovativeness to measure innovativeness. These researchers found that nursing managers and clinical nursing experts generally had a high level of innovative abilities and behaviours compared with general clinical nurses. Compared to these studies, there is an obvious shortage of nursing innovation talent in China. Zhang et al. (14) conducted a survey of 1120 nurses from three tertiary hospitals in Harbin in 2017. The results showed that the average score of innovative behaviour of nurses was 4.22 ± 0.92 . The majority (89.47%) had a low to medium level of innovative behaviour. Similarly, Chen et al. (15) investigated the innovation ability of 1260 clinical nurses in Zhengzhou in 2019. The nurses' position, professional title, working years, leadership and job satisfaction as well as the organizational innovation climate were the main factors affecting their innovation ability (16-18).

Scholars have developed different strategies to address the lagging innovation ability of clinical nurses (19, 20), and they include providing education and training on innovation processes and lean techniques, scheduling time for brainstorming among teams and solving problems together, providing resources, such as financial, information, personal, and emotional support, and actively adjusting the talent cultivation model to meet the current need for innovative nursing talent for the development of healthcare services (6, 21-24). While these contextual factors are important, innovations will not occur unless basic knowledge of innovation and research is provided to motivated and competent nurses (22).

Studies have found that cultivating nurses' research ability has benefits in promoting the nursing discipline (25), improving leadership (26), enhancing patient-centred care (27) and facilitating innovation development (28). A large sample survey from China showed that the nurses' scientific research participation rates (with 4.1%, 7.9%, 5.4%, and 2.0% in research projects, research attendance, papers published, and patent, respectively) and their self-rated research skills 25.00 (12.50, 37.50) were very low (29). However, their research training needs were relatively high 53.12(37.50, 75.00) (29). In our previous study, we found that 89.2% nurses had a weak research ability (30). Therefore, research training with content tailored to individual characteristics and capacities should be provided for nurses.

A workshop is a method for solving problems in which individuals (between 25 and 40 people) who are in the same scientific or technical field attend through activities, discussions, short lectures and other approaches (31). We report on an intervention study of a nursing innovation workshop in clinical practice education. It is a collaborative and constructive teaching organization that involves attracting participation, provoking thought, and promoting interaction and growth (32). The methods of case analysis, role play, group sharing; group discussion, brainstorming, teacher commenting and behaviour training have been widely used in foreign countries (33-35). In nursing, researchers highly emphasized the use of workshops for nursing education, professional development and clinical skills and have not focused on their use as a nurse innovation enhancement tool and scientific research methodology (32, 35, 36).

Therefore, the aim of this study was to conduct nursing innovation training through a teaching organization workshop and explore its influence on the innovation ability of clinical nurses. We hypothesized that nurses who were given the opportunity to participate in the nursing innovation workshop would nurture and enhance their innovation ability and research ability significantly. Moreover, we hypothesized that they would have more nursing innovations or research output in future work.

Methods

Design, setting and participants

A pre-test and post-test quasi experimental study was conducted at a tertiary hospital in Nanhai district, including one group with baseline data and follow-up assessment data.

Clinical nurses who met the criteria were recruited for this study. The inclusion criterion was registered nurses who had worked for more than 1 year. The exclusion criteria were as follows: (1) registered nurses who did not work in the hospital during the investigation period (including those who went out for further study and sick leave) and (2) registered nurses who were participating in other teaching programmes or studies. According to the literature review, we found that the sample size of the workshop should be between 25 and 40 people (31, 36). The optimal sample size calculation was based on the results of previous research and the results of using G*Power3 (37). An a priori paired t test indicated that a total sample size of 35 was needed to achieve 80% power to detect an interaction effect size of 0.50 at the 0.05 level of significance. Considering that there might be potential 10% attrition rate during the program, a total of 39 participants were targeted in this study. Ultimately, 37 participants were enrolled in the study. All of the participants completed the study.

Ethical approval of this study was granted by the Ethics Committee of the People's Hospital of Nanhai District Foshan, Guangdong. The nurses received information about the study and voluntary participation and provided informed consent before data collection. Furthermore, the participants were informed that they had the right to withdraw from the study at any time without any explanations or consequences.

Intervention

A nursing innovation workshop was administered by a research team composed of 10 members, including one director and one deputy director of the nursing department, one ward head nurse, one research nurse, one clinical evidence-based nursing tutor, one director of nursing education and 4 education nurses from different wards. Their responsibilities were to establish a workshop team, recruit members, conduct research on innovation, formulate training content for scientific research and innovation, and contact relevant experts to organize and implement learning on relevant topics.

According to the recruitment situation, the group was divided into 4 groups of 8-10 people. The innovation team leader was selected based on the investigation by the research team and the recommendation of the innovation team members. The team leader was required to have an intermediate or above professional title, obtain one or more patents, and have solid knowledge of innovation and scientific research capabilities with a rigorous and pragmatic academic attitude and good communication skills. The responsibilities of the team leader were to lead the members to implement innovation and offer consultation to the members.

Aiming to understand the participants' training need, we designed a questionnaire to investigate their training motivation, training methods, scientific research innovation experience and relevant factors affecting training according to the literature review (38, 39). Then, we developed a specific learning course (including the theoretical training and practical training) through the analysis of the current needs of nurses.

Theoretical training involved 12 hours of courses (once a week for two hours) that were mainly taught and guided by domestically and provincially experienced innovation experts. The content involved current innovation policies, innovative thinking training, patent development, application and transformation and some relevant typical innovation cases to encourage the nurses' participation.

Practical training was accomplished with the help and support of the innovation group leaders. The main content involved conducting innovations to solve clinical problems and ultimately completing the production of product prototypes. At the end of the theoretical course, members of each group were required to brainstorm, choose their own topics, conduct a product demand survey, and conduct innovative design and resource retrieval to realize their creative ideas. The members of each group were given different roles and responsibilities to maximize the function of the team. After finishing the innovative protocol, they submitted it to the research team for discussion, optimization and amendment. Finally, there was a competition for patented products to enhance the participants' innovative spirit after the completion of practical training. An outline of the courses and their content provided to participants in the innovation workshop intervention is shown in the course table.

Outcome measures

The primary outcome in this study was clinical nurses' innovation ability, which was assessed using the Scale of Clinical Nursing Staff Innovation Ability (4). This scale was divided into 4 dimensions with 41 items, including the nurses' innovation subjects (17 items), innovation process (12 items), innovation environment and pressure (7 items) and innovative products (5 items) (4), and it was a five-point ordinal scale (1-5) with a maximum score of 205 points, with a higher score corresponding to higher innovation ability (4). Relevant studies showed that the scale-level content validity index (S-CVI) was 0.953, the Cronbach's α coefficient was 0.938, and the test-retest reliability was 0.67 (4, 15). In our study, the Cronbach's coefficient of this scale before and after intervention was 0.789 and 0.945, respectively.

The second outcome in this study was clinical nurses' research ability, which was assessed using the Scale of Nursing Scientific Research Ability, which was designed by Yin-he Pan (40) from Shanxi Medical University in China. This scale has 6 dimensions and 30 items, including the ability to generate research ideas (3 items), the ability to search and review literature (5 items), the ability to design a research protocol (5 items), the ability to conduct research (6 items), the ability to analyse research data and material (5 items), and the ability to write a research report (6 items) (40). The scale was a five-point ordinal scale (0-4) with a maximum score of 120 points; a higher score represents a higher level of research ability (40). Relevant studies showed that the Cronbach's α coefficient of the total scale is 0.861 and the Cronbach's α coefficient of each dimension

is 0.655~0.760. One month later, the correlation coefficient of the total scale of test-retest reliability is 0.902 (30). In our study, the Cronbach's coefficient of this scale before and after intervention was 0.946 and 0.973, respectively.

The time points for assessment were at zero (pre-intervention) and 3 months (follow-up). Participants were assessed by completing the questionnaires through an online anonymous star thematic survey questionnaire. In addition, a sociodemographic questionnaire assessed the baseline characteristics, including the gender, age, foundational education, highest academic credential, professional title, length of service, nursing duties and department.

Data analysis

Statistical analyses were conducted using SPSS 22.0(IBM Corp.,Armonk, USA) statistical software. The general data of clinical nurses were described by the frequency, percentage, mean and standard deviation. The clinical nurses’ scores for innovation ability and scientific research ability were described by the mean, standard deviation, median and interquartile range. Wilcoxon signed rank tests were used to analyse differences within the group before and after intervention. Non-parametric tests were used because the majority of factors did not have a distribution. The level for statistical significance was set at $p\leq0.05$ (two-tailed).

Results

The course table of the innovation workshop is shown in Table 1, and the demographic characteristics of the participants are listed in Table 2. The sample included 37 nurses ranging in age from 27 to 48 years, with a mean age of 38 years. The majority were female (94.6%) and had no previous higher education (67.6%) and a bachelor’s degree or above through on-the-job training (100%). Most of them were supervisor nurses from internal medicine and surgical departments, and they had been working in the hospital for more than 10 years (64.9%) with no special position (60.4%). Most of the nurses decided to participate in this workshop to improve their innovation ability (35.2%). Case analysis (94.6%), group discussion and sharing (81.1%), brainstorming (86.4%) and expert comments (86.4%) were their favourite training methods. Finally, most of them had no previous patents (89.2%), and the main influencing factor was a lack of innovation knowledge (81.1%).

Table 1 Course table of the innovation workshop

Course	Theme	Aim	Content	Time
Theoretical Training (once a week for two hours)	Project introduction	Understanding the purpose of the workshop and the rationale for the curriculum design	Introduction to the purpose of establishing the workshop and the designing the course content	0.5 h
	Progress in nursing innovation development	Acquiring the knowledge of nursing innovation development	1. Introduction to the future direction of nursing innovation 2. Understanding the current innovation policy 3. Introduction to the application and transformation process of some nursing innovative products.	1.5 h
	Innovative design thinking	Cultivating innovative design thinking and incorporating it into practice	1. Introduction to the concept and characteristics of innovative design thinking 2. Understanding the difference between innovative design thinking and traditional thinking	2 h
			3. Introduction to the thinking tools: brainstorming, divergent and convergent creative thinking	2 h
			4. Learning how to implement creative design thinking steps: requirement observation, literature review, theme formulation, scheme design, feasibility analysis, action plan, Scheme promotion	4 h
			5. Learn how to sketch a product design	2 h
Practical training (18 W)	Discover stage	Identifying clinical problems and exploring patient needs	Each group chooses its own innovation theme through communication, division of labor and research	4 W
	Design Stage	Proposing innovative design schemes and from prototypes	The team collaborates to propose innovative design solutions for the theme, and forms a preliminary product prototype	10 W
	Deliver Stage	Displaying and promoting final innovative solutions and products	Submit innovative proposals to the research team for first review	2 W
			Hold nursing innovation competition, report and promote innovative programs	2 W

Title of data 2: Socio-demographic characteristics and training demands of clinical nurses participating in the nursing workshop (n=37)

Table 2 Socio-demographic characteristics and training demands of clinical nurses participating in the nursing workshop (n=37)

Characteristic		N (%)	Characteristic		N (%)
Gender			No		22(60.4)
	Male	2 (5.4)	Department	Internal medicine	12 (32.5)
	Female	35 (94.6)		General surgical	11 (29.7)
Age (years)	27~30	3 (8.11)	Gynaecology and paediatrics		4 (10.8)
	31~40	25 (67.57)		Critical care unit	4 (10.8)
	41~48	9 (24.3)		Other*	6 (16.2)
			Main training motivation		
Foundational education			Promotion needs		
Technical secondary school		10 (27.1)	Job demand		
Junior college		15 (40.5)	Self-improvement		
Bachelor's degree		12 (32.4)	Training methods (multi-select)		
Highest academic credential	Bachelor's degree	35 (94.6)	Case analysis		
	Master's degree	2 (5.4)	Role play		
			Group discussion and sharing		
Professional title			Brainstorm		
Junior nurse		5 (13.51)	Expert comments		
Supervisor nurse		17 (46.0)	Number of patent		
Deputy chief nurse		13 (35.1)	0		
Chief nurse		2 (5.4)	1		
Length of service (years)			2		
3~10		4 (10.8)	Innovation influencing factors (multi-select)		
11~20		24 (64.9)	Busy work		
21~30		9 (24.3)	Lack of innovation knowledge		
Head nurse			Reward factor deficiency		
	Yes	15 (40.6)			

* Others refer to operating rooms, outpatient clinics and supply rooms.

Title of data 3: Clinical nurses’ innovation ability at baseline and follow-up with change over time in the group (N=37)

Before and after 3 months of training, there were statistically significant differences in the total scores of clinical nurses' innovation ability ($Z=-5.32$, $P<0.001$), innovation subjects ($Z=-5.32$, $P<0.001$), innovation process ($Z=-5.33$, $P<0.001$), innovation environment and pressure ($Z=-5.19$, $P<0.001$), and innovative products ($Z=-5.20$, $P<0.001$) (Table 3).

Table 3 Clinical nurses’ innovation ability at baseline and follow-up with change over time in the group (N=37)

Measurement factors	Baseline	Follow-up	ΔScore					
			Mean±SD	Median Score	Interquartile range	Z value	P value	95%CI
Innovation subjects	60.24±7.39	64.46±7.93	4.22±1.97	4.00	2.50~6.00	-5.32	0.001	3.56~4.87
Innovation process	42.14±4.61	45.86±4.69	3.73±1.56	4.00	2.00~5.00	-5.33	0.001	3.21~4.25
Innovation environment and pressure	23.89±3.45	27.32±3.60	3.43±1.74	3.00	2.00~5.00	-5.19	0.001	2.85~4.01
Innovative products	13.03±4.34	15.57±4.83	2.54±1.30	2.00	2.00~4.00	-5.20	0.001	2.11~2.98
Total score of innovation ability	139.30±15.42	153.22±16.51	13.92±3.38	13.00	12.00~16.00	-5.32	0.001	12.79~15.05

ΔScore: Change between baseline and follow-up

Title of data 3: Clinical nurses’ innovation ability at baseline and follow-up with change over time in the group (N=37)

Before and 3 months after the training, the total score of clinical nurses' scientific research ability ($Z=-5.31$, $P<0.001$), ability to generate research ideas ($Z=-5.19$, $P<0.001$), ability to search and review literature ($Z=-5.11$, $P<0.001$), ability to design research protocol ($Z=-4.49$, $P<0.001$), ability to conduct research ($Z=-5.26$, $P<0.001$), ability to analyse research data and material ($Z=-4.81$, $P<0.001$), and ability to write a research report ($Z=-4.89$, $P<0.001$) showed statistically significant differences (Table 4).

Table 4 Clinical nurses’ scientific research ability at baseline and follow-up with change over time in the group (N=37)

Measurement factors	Baseline	Follow-up	△Score					
			Mean±SD	Median Score	Interquartile range	Z value	P value	95%CI
Ability to generate research ideas	6.03±1.76	7.97±1.94	1.95±1.13	2.00	1.00~3.00	-5.19	0.001	1.57~2.32
Ability to search and review literature	8.38±2.70	12.00±3.87	3.62±2.38	3.00	2.00~5.00	-5.11	0.001	2.83~4.42
Ability to design research protocol	6.68±3.17	9.43±4.29	2.76±2.33	3.00	1.50~4.00	-4.49	0.001	1.98~3.53
Ability to conduct research	8.41±3.32	11.65±3.96	3.24±1.79	3.00	2.00~5.00	-5.26	0.001	2.65~3.84
Ability to analyse research data and material	5.14±3.16	7.59±3.80	2.46±1.85	2.00	1.00~4.00	-4.81	0.001	1.84~3.08
Ability to write a research report	8.86±3.49	12.03±4.32	3.16±2.42	3.00	2.00~5.00	-4.89	0.001	2.35~3.97
Total score of scientific research ability	43.49±13.30	60.68±18.44	17.19±8.41	15.00	11.00~21.00	-5.31	0.001	14.39~19.99

△Score: Change between baseline and follow-up

Title of data 4: Clinical nurses’ scientific research ability at baseline and follow-up as change over time in the group (N=37)

Discussion

The general aim of study was to examine the effect of the innovation workshop. One pre-test and post-test quasi experimental design was conducted in this study. After the intervention (follow-up), the mean scores of innovation ability and research ability of nurses increased significantly ($P<0.001$).

Similarly, Jiang Yan (38) and Zhang Ziyun (39) performed quasi-experimental studies aimed to assess the effect of an half a year theory-driven innovative interventions and found that innovative training improved the nurses’ innovation behaviour. In addition, Hsing-Yuan Liu (11) also reported the improvement of innovative behaviour of nursing faculty after participating in a 2-day teaching creativity workshop. Possible explanations for these results are included as follows.

First, few current intervention studies have been performed on the training of nurses' innovation ability and most nurses have great training demands. The workshop was established and guided by tutors with rich innovation experience and provided an open, democratic and inclusive organizational culture that embraced innovativeness and empowered nurses to advance new ideas, enhance interactions, improve their self-confidence and self-esteem and exert an obvious positive influence on individual innovation behaviour (41-43).

Second, the training content, which was based on the core elements of innovation ability and the actual training needs of clinical nurses through preliminary survey removed the constraints of the traditional thinking mode, emphasized the stimulation of members' independent thinking and learning ability (39) and opened up a new way of nursing innovation education and research training.

Third, the course is divided into theory course and practice course. After 12 hours of participation in the workshop with different themes in theoretical training, participants could recognize the concept of nursing innovation and basic steps. In addition, cultivating innovative design thinking can also promote scientific research thinking and critical thinking (11). In practice courses, participants could give full play to their subjective initiatives to identify problems in nursing practice and use creative thinking strategies to create prototypes of the devices they envisioned with the help of the workshop members (11). In addition, the workshop adopted diverse training methods, such as participatory methods and case discussions, to encourage team members to actively participate in thinking and discussing questions to promote the participants' learning and cultivate innovative thinking (35). Moreover, a WeChat group was used to enhance trust, a spirit of inquiry, the value for learning, and resource support for innovativeness and experimentation (19) to further enrich the innovative atmosphere.

Finally, we identified four group leaders with rich innovation experience to guide the members in conducting research on the transformation of clinical problems into innovative topics, which helped to improve the participants' familiarity with the innovation process as well as their innovative thinking and spirit, thereby improving nurses' innovation practice without practical training guidance and enhancing nurses' confidence and practical ability in nursing innovation (7).

Another interesting finding of this study was that 40.6% of head nurses participated in this training, which was consistent with Chen et al. (15). Although some foreign nursing schools have attempted to establish "nursing innovation" to combine nursing professional education with innovation (9, 33), innovation in clinical nursing education in China is still in the initial state (38). Key nursing staff members, such as nurse leaders, were the main participants in the innovation ability training programme, indicating that nursing leaders attached great importance to nursing innovation to help themselves learn to be more creative (13, 19, 44). As the key power of nursing management and promoters of nursing tasks, key nursing staff had excellent theoretical knowledge and professional skills and were responsible for the nursing quality and nursing safety (45). Many key nursing staff had a highly professional sense of mission, high levels of job involvement and successful innovation through on-the-job innovation training (16). In addition, the nurse leader participants in this study could provide good examples to inspire creativity and could provide education to empower staff to use creative thinking techniques to solve problems in practice (17, 19, 43, and 45).

Since this study was the first to conduct a nursing innovation workshop in one district hospital, the research scheme had high feasibility and operability and was popular with the participants, although it also had some limitations. First, only one hospital was included and the number of participants was small, which could increase the risk of selection bias. Second, the design was quasi-experimental; therefore, the results cannot be entirely attributed to the effect of the interventions since the whole design lack a control group. Thus, this outcome evaluation will benefit substantially if complemented with good qualitative findings. In addition, this study needs to be further verified in more hospitals and among more nurses.

Conclusion

The present results indicate that nursing innovation workshops can improve clinical nurses' innovation ability and provide a new way of thinking and a new method for teaching about innovation. With regard to the other variables, we found that innovative creative thinking can promote the development of scientific research thinking to improve clinical nurses' research ability. Further interventions designed as randomized control trials with larger groups from different levels of hospitals would be useful to confirm the present findings on the effect of nursing innovation workshops on the cultivation of nurses' innovation ability.

Abbreviations

ANA: American Nurses Association

Declarations

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Ethical approval

The study was approved by the Ethics Committee of the People's Hospital of Nanhai District, Foshan, Guangdong (Ethical review number: 2019015). We explained the purpose and procedure to each participant, and they were free to withdraw from the study at any time. We got written consents from all participants before enrolment.

Consent for publication

Not applicable

Competing interests

No conflicts of interest have been declared by the authors.

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Availability of data and materials

The data generated and analysed in this study are not publicly available but may be available from the corresponding author on reasonable request.

Author's contributions

LG: Conceptualization, Methodology, Writing-Original Draft preparation

QL: Conceptualization

XH: Data Curation, Software, Investigation

JO: Funding acquisition, Data Curation

MW: Conceptualization, Methodology, Investigation, Writing-Reviewing and Editing

Statement: All authors have read and approved the manuscript

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