Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Development of a fertility preservation training programme for breast surgical nurses caring for childbearing-age patients with breast cancer: a Delphi study

Qi Wang
Henan Provincial People's Hospital
Cancan Chen
ccchen0228@126.com

Henan Provincial People's Hospital
Pei Zhao
Henan Provincial People's Hospital
Hong Mei Zhang
Henan Provincial People's Hospital
Pi Lei Si
Henan Provincial People's Hospital

Research Article

Keywords: breast surgical nurses, breast cancer, fertility preservation, training programme, Delphi study, nursing

Posted Date: November 3rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11169066/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Aims

This study aimed to construct a targeted fertility preservation training programme for breast surgical nurses caring for childbearing-age patients with breast cancer.

Background

Fertility status is a core component of quality of life among childbearing-age patients with breast cancer, which places urgent demands on the fertility preservation competency of breast surgical nurses. Although several educational programs on cancer reproductive care have been reported, a standardized fertility preservation training programme tailored to breast surgical nurses and adapted to the domestic healthcare context and policy priorities in China remains lacking.

Methods

The preliminary version of the training programme was formulated based on systematic literature review and semi-structured interviews. A two-round Delphi expert consultation was subsequently performed to finalize the formal training programme.

Results

The finalized programme consisted of four modules: training objectives, training content, training methods, and assessment strategies. The training objectives contained 3 primary indicators and 18 secondary indicators, and the training content comprised 6 primary indicators and 26 secondary indicators. Both training methods and assessment strategies included 6 primary indicators respectively. The valid response rate of both rounds of expert consultation was 100%. The expert authority coefficients were 0.857 and 0.870, and the coefficients of variation ranged from 0 to 0.358 and 0 to 0.196, respectively. Kendall's coordination coefficients were 0.303 and 0.325 (all $P < 0.05$), indicating good expert consistency.

Conclusions

This training programme was developed through a rigorous and standardized process with good expert authority and consensus. Featuring strong specialty relevance and a relatively complete training and assessment system, it can effectively meet the targeted training needs of breast surgical nurses for fertility preservation care.

Implications for practice

Future studies should implement the programme in clinical nurse training and further verify its practical effectiveness and applicability in real-world clinical settings.

Introduction

Breast cancer is the most prevalent malignant tumour among women of childbearing age [1, 2]. According to the latest data released by the National Cancer Center of China, there are approximately 420,000 new cases of breast cancer in China each year, ranking first among female cancers, and patients with childbearing-age breast cancer account for around 40% of all breast cancer cases [3]. With advances in medical care, the 5-year survival rate of childbearing-age patients with breast cancer reaches 87.1% [4]. Of these patients, 50.7% have a strong desire for future pregnancy [5]; however, anti-neoplastic treatment may cause irreversible damage to fertility [6]. Surveys have shown [7] that the pregnancy rate of childbearing-age breast cancer patients is the lowest among all cancer populations, standing at only 3%, which is 40% lower than the pregnancy rate in the general population. Fertility preservation techniques make future childbearing possible for breast cancer patients [8]. Nevertheless, fertility preservation for breast cancer patients has not received widespread attention in China. As many as 76.8% of patients lack knowledge regarding fertility preservation [9], and 94.2% are unwilling to undergo fertility preservation interventions [10].

To address the fertility needs of childbearing-age patients with breast cancer, the 4th International Consensus Guidelines for Young Women with Breast Cancer issued by the ESMO [11] and guidelines on fertility preservation for cancer patients [12] clearly state that clinical healthcare professionals should discuss the risk of potential infertility with patients and introduce available fertility preservation options as early as possible before the initiation of treatment. As primary health navigators for patients, nurses play a vital role in delivering fertility preservation education, referrals and information counselling [13]. The American Society of Clinical Oncology (ASCO) [14] recommends involving nurses in clinical discussions and referrals concerning fertility preservation for patients of childbearing age with cancer. Nevertheless, the clinical practice of Chinese nurses participating in fertility preservation care for breast cancer patients remains suboptimal. As many as 41.1% of healthcare workers lack knowledge of fertility preservation [15], and only 28.5% of nurses discuss fertility preservation issues with their patients [16]. This may cause patients to miss the optimal window for fertility preservation and result in decisional regret [17]. Insufficient professional knowledge and inadequate competencies such as communication skills are the main barriers preventing breast surgical nurses from engaging in fertility preservation care for childbearing-age breast cancer patients [18, 19]. Studies have shown [16] that merely 26.9% of nurses have received training related to fertility preservation. Therefore, it is imperative to strengthen training on fertility preservation knowledge and skills for breast surgical nurses.

Anazodo et al. [20] developed the international oncofertility core competency framework, which specified the core competencies required for healthcare professionals, including fertility preservation knowledge,

communication skills, decision support, psychological support, follow-up management and so on, providing a theoretical basis for the design of training content. Among specific training programmes, the ENRICH programme in the United States is the most systematic, and its training content covers infertility, fertility preservation options, sexual health, alternative family building and professional skill development [21–24]. Winterling et al. [25], a Swedish scholar, developed the Fex-talk programme, which mainly focuses on the impacts of cancer and its treatment on sexual health and fertility. A web-based fertility preservation training programme for nurses in Japan [26] includes an overview of fertility preservation, fertility preservation registries, cryopreservation protocols and psychosocial support. In China, only Qu Ping [27] has constructed a fertility preservation training programme for oncology nurses for cancer patients, which mainly includes reproductive physiology, assisted reproductive technology, factors affecting fertility, fertility assessment, an overview of fertility preservation and other contents. Domestic and international researchers have actively explored the training content of fertility preservation for oncology nurses, but no fertility preservation training programme for breast surgical nurses caring for childbearing-age breast cancer patients has been developed so far. Domestic and international studies [28–31] have emphasized the need to improve breast surgical nurses' ability to provide fertility preservation knowledge and related services for childbearing-age breast cancer patients and to develop fertility preservation training programmes for breast surgical nurses caring for childbearing-age breast cancer patients. However, breast surgical nurses currently have insufficient knowledge reserve of fertility preservation for childbearing-age breast cancer patients, inadequate professional competencies including communication skills, and a lack of systematic fertility preservation training programmes [29, 31–32]. Therefore, this study aims to develop a fertility preservation training programme for breast surgical nurses caring for childbearing-age breast cancer patients based on the international oncofertility core competency framework and the ADDIE model, so as to provide a reference for training breast surgical nurses who can meet patients' clinical decision-making service needs regarding fertility preservation.

Methods

Design

Based on a comprehensive literature review and semi-structured interviews, we developed the preliminary version of the fertility preservation training programme for breast surgical nurses caring for childbearing-age breast cancer patients. On this basis, the Delphi questionnaire was designed, and two rounds of expert consultation were conducted to finally reach a consensus.This study was reported in accordance with the Delphi studies in social and health sciences – recommendations for an interdisciplinary standardized reporting (DELPHISTAR) reporting guideline[33].The study protocol was not prospectively registered.

Development of the training programme

The research team consisted of eight members, including two breast surgery specialists, two reproductive medicine specialists, two nursing education experts, one breast surgical nurse and one reproductive medicine nurse. The research team first developed the preliminary version of the fertility preservation training programme for breast surgical nurses caring for childbearing-age breast cancer patients through literature review, semi-structured interviews and preliminary research findings of the research group [34].

On the basis of the international oncofertility core competency framework (including fertility preservation knowledge, communication skills, decision support, psychological support, follow-up management and so on), we systematically searched Chinese and English databases including China Biomedical Literature Database, CNKI, Wanfang Data, VIP, PubMed, Web of Science, Embase, EBSCO and Cochrane Library. The search period was from database establishment to January 2026. Search terms included “breast neoplasm/breast cancer”, “nursing staff/medical personnel” and “fertility/fertility preservation/assisted reproduction/reproductive protection”. Consistent search terms were adopted for both Chinese and English databases. Meanwhile, websites of the National Health Commission of the People’s Republic of China, Chinese Nursing Association and Ottawa Hospital Research Institute’s Ottawa Decision Support website were retrieved, and relevant books were consulted, such as *Fertility Preservation for Breast Cancer Patients*, *Standardized Guideline Manual for Female Fertility Preservation, Fertility Preservation, Fertility Protection and Preservation, Fertility Protection and Reproductive Reserve, and Clinical Techniques for Fertility Protection and Preservation*. The included relevant papers, regulations, policies and standards were analysed, extracted and screened to form the preliminary version of the training programme. The preliminary programme contained 3 primary indicators and 18 secondary indicators for training objectives, 6 primary indicators and 27 secondary indicators for training content, and 6 primary indicators each for training methods and assessment approaches.

Subsequently, purposive sampling was used to recruit participants for semi-structured interviews, including breast surgery/medical oncology/reproductive medicine specialists, nursing managers and nursing educators from tertiary general hospitals and universities. In addition, key stakeholders such as childbearing-age breast cancer patients and their family members were interviewed. The main interview questions were as follows: (1) What are your views on the current status of fertility preservation training for breast surgical nurses caring for childbearing-age breast cancer patients? (2) In your opinion, what knowledge, skills, competencies and qualities should breast surgical nurses possess regarding fertility preservation for childbearing-age breast cancer patients? (3) What fertility preservation-related services do breast surgical nurses mainly provide for you? (4) Based on your current needs, what kind of support do you expect breast surgical nurses to offer? (5) What is your satisfaction with the existing nursing services related to fertility preservation delivered by breast surgical nurses, and what improvements would you suggest? (Questions 3 to 5 were posed to childbearing-age breast cancer patients and their family members.) Content analysis was applied for data analysis, and data collection and preliminary analysis were conducted simultaneously during the interview phase. Through this process, the preliminary training programme was refined. The revised draft contained 3 primary indicators and 20

secondary indicators for training objectives, 6 primary indicators and 29 secondary indicators for training content, and 6 primary indicators each for training methods and assessment approaches.

Identification of the advisory experts

The number of Delphi consultants should be controlled between 15 and 30 to avoid homogeneity of research subjects [35]. From March 2026 to May 2026, the research team distributed questionnaires via email to 15 experts from tertiary general hospitals and medical universities for consultation. Expert inclusion criteria: Associate senior title or above, or master's degree or above; or intermediate title or above; or bachelor's degree or above with no less than 10 years of working experience in breast surgery, nursing education, medical oncology or reproductive medicine; High enthusiasm and willingness to participate in the correspondence consultation.

The expert consultation questionnaire

The expert consultation questionnaire mainly consisted of the following four parts: (1) Questionnaire introduction: this section described the research background, objectives, significance and instructions for completing the questionnaire. (2) Main body of the questionnaire: the specific content covered training objectives, training content, training methods and assessment approaches. A 5-point Likert scale was adopted, with scores from 1 to 5 representing "not important", "slightly important", "moderately important", "quite important" and "extremely important", respectively. A comment column was set for each indicator, where experts could provide opinions or suggestions. (3) General information survey: including demographic information such as age, educational level, occupation, professional title and working years. (4) Self-assessment sheet: experts were required to evaluate their familiarity with the consultation content and their judgment basis.

Consulting and feedback cycle

Expert consultations were conducted in March 2026 and May 2026 respectively. The expert consultation forms were distributed via email or face-to-face paper questionnaires, and reminder emails were sent two weeks later. After the first round of consultation, the data were statistically analysed. Expert opinions were integrated, and group discussions and revisions were performed to develop the questionnaire for the second round of expert consultation. After the second round of consultation, expert opinions tended to converge, and the consultation was terminated. Indicator screening criteria: importance score ≥ 3.50, coefficient of variation < 0.25, and full-mark rate ≥ 20% [36]. An expert authority coefficient ≥ 0.700 indicates reliable consultation results; a higher expert authority coefficient represents greater expert authority [37].

Statistical analysis

Excel 2021 and SPSS 27.0 were used for data entry and statistical analysis. Enumeration data were described by frequency and percentage, and measurement data were expressed as mean and standard deviation; the degree of variation was represented by the coefficient of variation, and Kendall's coefficient of concordance was used to evaluate the degree of coordination of expert opinions. The effective questionnaire response rate was used to reflect expert enthusiasm. The authority coefficient (Cr) was adopted to evaluate expert authority, where Cr = (Ca + Cs)/2. Ca represents the judgment basis, and Cs represents the degree of familiarity.

Ethics and study approval date

This study was approved by the Ethics Committee of Henan Provincial People's Hospital on 30 May 2024 (Registration No.: (2024) Lun Shen No. (116)). The study complied with the principles of the Declaration of Helsinki. All participants signed informed consent forms and took part in the study anonymously.

Results

General information of the experts

A total of 15 experts from tertiary general hospitals and medical universities participated in the two rounds of correspondence consultation in this study. The expert panel was multidisciplinary, including 5 breast-surgery medical specialists (33.33%), 4 breast-surgery nursing specialists (26.67%), 1 medical-oncology nursing specialist (6.67%), 1 surgical nursing education expert (6.67%), 2 reproductive-medicine medical specialists (13.33%), and 2 reproductive-medicine nursing specialists (13.33%).The age of the 15 consulted experts ranged from 36 to 60 (44.80 ± 6.25) years, and their working years in relevant specialties ranged from 7 to 30 (16.33 ± 8.46) years. Among them, 5 held doctoral degrees, 7 held master's degrees and 3 held bachelor's degrees; 12 had associate senior titles or above, and 3 had intermediate professional titles.

The degree of experts' activeness and authority

Fifteen questionnaires were distributed in the first round of consultation, and 15 valid questionnaires were returned, yielding an effective response rate of 100%. Twelve experts (80.00%) provided comments or guidance. In the second round, 15 questionnaires were distributed and 15 valid questionnaires were returned, with an effective response rate of 100%. Five experts (33.33%) offered comments or guidance, indicating high attention and enthusiasm among the experts for this study. The Ca values of the two rounds of experts were 0.887 and 0.900 respectively, the Cs values were 0.827 and 0.840 respectively, and the Cr values were 0.857 and 0.870 respectively, demonstrating high expert authority in this study.

The degree of coordination of experts' opinions

The coefficients of variation for the two rounds of expert consultation ranged from 0 to 0.358 and from 0 to 0.196, respectively. Kendall's coefficients of concordance were 0.303 and 0.325, respectively, and the significance tests were all statistically significant ($P < 0.001$).

The results of the expert consultation

Results of the first round consultation

After the first round of expert consultation, based on the indicator screening criteria, expert opinions and the discussion results of the research group,In the training objectives, two secondary indicators with an importance score < 4.0 and a coefficient of variation > 0.25 were deleted from the knowledge objectives (“Master the core obstetric management content of assisted reproduction and post-pregnancy management for childbearing-age breast cancer patients after anti-tumour treatment”, “Master the management content of health follow-up for childbearing-age breast cancer patients receiving assisted reproduction and their offspring”); in the training content, one secondary indicator was added, three secondary indicators were deleted, two secondary indicators were merged, and five secondary indicators were revised. The specific revisions were as follows: (1) Addition of one secondary indicator: “Implementation principles and eligible population of fertility preservation for childbearing-age breast cancer patients” was added under “Overview of fertility preservation”; (2) Deletion of three secondary indicators with an importance score < 4.0 and a coefficient of variation > 0.25: “Indications for fertility preservation”, “Overview of medical insurance policies and medical expenses related to fertility preservation”, “Perioperative guidance of fertility preservation for breast cancer patients”; (3) Merger of two secondary indicators: “Benefits and risks of fertility preservation techniques” and “Advantages and disadvantages of different fertility preservation techniques” were merged into “Advantages, disadvantages, benefits and potential risks of different preservation techniques”; (4) Revision of five secondary indicators: “Material basis and regulation of reproductive endocrinology” was revised to “Material basis of reproductive endocrinology and gonadal axis regulation”; “Effects of chemotherapy on fertility” was revised to “Mechanisms of chemotherapy-induced damage to follicles and ovarian reserve”; “Effects of radiotherapy on fertility” was revised to “Damage of pelvic radiotherapy to reproductive organs”; “Effects of endocrine therapy on fertility” was revised to “Long-term impacts of endocrine therapy on reproductive endocrinology”; “Effects of targeted therapy on fertility” was revised to “Reproductive adverse reactions related to targeted therapy”. Two items of training methods and two items of assessment approaches were revised.

Results of the second round consultation

During the second round of consultation, experts reached roughly consistent opinions on all indicators: no constructive suggestions were put forward to delete or add items, and only revision suggestions on the wording of some items were provided. All indicators met the preset statistical criteria; therefore, the consultation was terminated. Based on the opinions and suggestions collected from the two rounds of expert consultation, the final fertility preservation training programme for breast surgical nurses caring for childbearing-age breast cancer patients was established. The training objectives contained 3 primary indicators and 18 secondary indicators; the training content contained 6 primary indicators and 26 secondary indicators; both training methods and assessment approaches contained 6 primary indicators each. See Tables 1–4.

Table 1
Results of the Delphi consultation on training objectives of the fertility preservation training programme for breast surgical nurses caring for childbearing-age breast cancer patients

Training objectives	Importance score (score, $\bar{x} \pm s$)	CV	Full-mark rate (%)
1.Knowledge objectives			
1.1 Understand the basic theoretical knowledge related to reproductive physiology	5.00 ± 0.00	0.000	100
1.2 Understand the basic concepts and professional connotations of fertility preservation for childbearing-age breast cancer patients	5.00 ± 0.00	0.000	100
1.3 Be familiar with the damage mechanisms of different anti-tumour treatment regimens on the fertility of childbearing-age breast cancer patients	4.60 ± 0.51	0.110	60.00
1.4 Master the progress of clinical application of fertility preservation techniques	4.67 ± 0.49	0.104	66.67
1.5 Master the core content of relevant clinical guidelines and expert consensus on fertility preservation for childbearing-age breast cancer patients	5.00 ± 0.00	0.000	100
1.6 Master the clinical care specifications and ethical principles of fertility preservation for childbearing-age breast cancer patients	4.27 ± 0.70	0.165	40.00
1.7 Master the referral indications, procedures and standardised management specifications of fertility preservation for childbearing-age breast cancer patients	4.07 ± 0.80	0.196	33.33
1.8 Master the key assessment points and intervention methods for psychological problems related to fertility preservation in childbearing-age breast cancer patients	4.47 ± 0.64	0.143	53.33
2.Skill objectives			
2.1 Be able to collaborate with the multidisciplinary team to carry out fertility health assessment, intervention and whole-course care management for childbearing-age breast cancer patients.	4.93 ± 0.26	0.052	93.33
2.2 Be able to proficiently use specialised communication skills to conduct fertility preservation-related communication and health guidance for childbearing-age breast cancer patients and their family members.	4.40 ± 0.51	0.115	40.00

Training objectives	Importance score (score, $\bar{x} \pm s$)	CV	Full-mark rate (%)
1.Knowledge objectives			
2.3 Be able to complete standardised referral work combined with clinical guidelines and the individual conditions of childbearing-age breast cancer patients.	4.73 ± 0.59	0.126	80.00
2.4 Be able to promptly identify negative emotions of childbearing-age breast cancer patients and their family members and provide individualised psychological support.	4.80 ± 0.41	0.086	80.00
2.5 Be able to comprehensively assess the fertility desire, ovarian function and risks of anti-tumour treatment-related reproductive damage of childbearing-age breast cancer patients, and deliver individualised health education on fertility preservation.	5.00 ± 0.00	0.000	100
2.6 Be able to implement full-cycle follow-up management of fertility preservation for childbearing-age breast cancer patients.	5.00 ± 0.00	0.000	100
3.Attitude objectives			
3.1 Consciously abide by nursing ethical principles, uphold professional ethics and practise humanistic care in the care of fertility preservation for childbearing-age breast cancer patients.	4.40 ± 0.51	0.115	40.00
3.2 Clarify the specialised development direction of fertility preservation for childbearing-age breast cancer patients, build professional identity and rationally plan career development.	4.93 ± 0.26	0.052	93.33
3.3 Take the initiative to learn specialised knowledge related to fertility preservation for childbearing-age breast cancer patients and continuously improve professional service capacity.	4.20 ± 0.78	0.185	40.00
3.4 Fully respect the privacy and the right of childbearing-age breast cancer patients to make autonomous fertility decisions.	5.00 ± 0.00	0.000	100

Table 2
Results of the Delphi consultation on training content of the fertility preservation training programme for breast surgical nurses caring for childbearing-age breast cancer patients

Training content	Importance score (score, $\bar{x} \pm s$)	CV	Full-mark rate (%)
1 Basic knowledge of reproductive physiology			
1.1 Anatomy and physiology of the female reproductive system	5.00 ± 0.00	0.000	100
1.2 Material basis of reproductive endocrinology and gonadal axis regulation	5.00 ± 0.00	0.000	100
1.3 Gametogenesis and follicular development	4.60 ± 0.51	0.110	60.00
1.4 Fertilisation and early embryonic development	5.00 ± 0.00	0.000	100
2 Impacts of comprehensive breast cancer treatment on fertility			
2.1 Impacts of surgical treatment on fertility	5.00 ± 0.00	0.000	100
2.2 Mechanisms of chemotherapy-induced damage to follicles and ovarian reserve	4.53 ± 0.64	0.141	60.00
2.3 Damage of pelvic radiotherapy to reproductive organs	4.53 ± 0.52	0.114	53.33
2.4 Long-term impacts of endocrine therapy on reproductive endocrinology	4.87 ± 0.35	0.072	96.67
2.5 Reproductive adverse reactions related to targeted therapy	4.53 ± 0.52	0.114	53.33
3 Overview of fertility protection and preservation			
3.1 Concepts and clinical significance of fertility protection and preservation	5.00 ± 0.00	0.000	100
3.2 Implementation principles and eligible populations for fertility protection and preservation in patients of childbearing age with breast cancer	5.00 ± 0.00	0.000	100
3.3 Core contents of clinical guidelines and expert consensus on fertility preservation	5.00 ± 0.00	0.000	100
4 Advances in clinical application of fertility preservation techniques			
4.1 Key points of fertility assessment for patients of childbearing age with breast cancer	4.47 ± 0.52	0.115	46.67

Training content	Importance score (score, $\bar{x} \pm s$)	CV	Full-mark rate (%)
1 Basic knowledge of reproductive physiology			
4.2 Principles, indications, contraindications and optimal intervention timing of various fertility preservation techniques	5.00 ± 0.00	0.000	100
4.3 Advantages, disadvantages, benefits and potential risks of different preservation techniques	5.00 ± 0.00	0.000	100
4.4 Factors affecting the success rate of fertility preservation and the impact of techniques on breast cancer prognosis	4.47 ± 0.52	0.115	46.67
4.5 Standardized clinical management procedures for fertility preservation	4.47 ± 0.52	0.115	46.67
4.6 Referral indications, interdisciplinary referral procedures and handover specifications	5.00 ± 0.00	0.000	100
4.7 Timing of pregnancy after comprehensive treatment of breast cancer and its potential risks	4.93 ± 0.26	0.052	93.33
5 Specialized nursing practice of fertility protection and preservation			
5.1 Whole-course nursing interventions for fertility protection and preservation	4.80 ± 0.41	0.086	80.00
5.2 Decision support, psychological support and communication guidance for patients receiving fertility preservation	4.53 ± 0.64	0.141	60.00
5.3 Identification and nursing interventions of common complications related to fertility preservation	5.00 ± 0.00	0.000	100
5.4 Ethical principles and legal norms associated with fertility protection and preservation	4.40 ± 0.51	0.115	40.00
6 Reproductive health management for patients of childbearing age with breast cancer			
6.1 Perinatal tumor-related risk assessment and management for breast cancer patients	5.00 ± 0.00	0.000	100
6.2 Individualized contraception health guidance	5.00 ± 0.00	0.000	100
6.3 Management of treatment-related perimenopausal symptoms	5.00 ± 0.00	0.000	100

Table 3
Results of Delphi consultation on training methods for fertility protection among breast surgical nurses caring for patients of childbearing age with breast cancer

Training contents	Training methods	Importance score (score, $\bar{x} \pm s$)	CV	Full-mark rate (%)
1 Basic knowledge of reproductive physiology	Lectures combined with online resource learning	4.87 ± 0.35	0.072	86.67
2 Impacts of comprehensive breast cancer treatment on fertility	Lectures, online resource learning and group discussion	5.00 ± 0.00	0.000	100
3 Overview of fertility protection and preservation	Lectures, online resource learning, and group discussion	4.53 ± 0.52	0.114	53.33
4 Advances in clinical application of fertility preservation techniques	Lectures, online resource learning, and case analysis	5.00 ± 0.00	0.000	100
5 Specialized nursing practice of fertility protection and preservation	Lectures, online resource learning, and scenario simulation	5.00 ± 0.00	0.000	100
6 Reproductive health management for patients of childbearing age with breast cancer	Lectures, online resource learning, and case analysis	4.53 ± 0.52	0.114	53.33

Table 4
Results of Delphi consultation on assessment methods for fertility protection training among breast surgical nurses caring for patients of childbearing age with breast cancer

Training contents	Assessment methods	Importance score (score, $\bar{x} \pm s$)	CV	Full-mark rate (%)
1 Basic knowledge of reproductive physiology	Theoretical assessment	4.53 ± 0.52	0.114	53.33
2 Impacts of comprehensive breast cancer treatment on fertility	Theoretical assessment	4.67 ± 0.49	0.104	66.67
3 Overview of fertility protection and preservation	Theoretical assessment	4.60 ± 0.51	0.110	60.00
4 Advances in clinical application of fertility preservation techniques	Theoretical assessment and case analysis assignment	4.93 ± 0.26	0.052	93.33
5 Specialized nursing practice of fertility protection and preservation	Theoretical assessment and standardized patient scenario simulation assessment	4.67 ± 0.49	0.104	66.67
6 Reproductive health management for patients of childbearing age with breast cancer	Theoretical assessment and case analysis assignment	4.67 ± 0.49	0.104	66.67

Discussion

Based on a comprehensive literature review, this study conducted semi-structured interviews in strict accordance with qualitative research requirements. The participants included specialists in breast surgery, medical oncology and reproductive medicine, nursing managers, nursing educators, as well as patients of childbearing age with breast cancer and their family members. Information regarding training needs for fertility protection among breast surgical nurses was collected to develop the Delphi consultation questionnaire.The consulted experts were recruited from tertiary general hospitals and medical universities across multiple provinces and municipalities. All experts had experience in breast cancer care, covering fields including breast surgery, breast surgical nursing, reproductive clinical medicine and reproductive nursing. All participants held intermediate or higher professional titles, and 12 experts possessed a master's degree or above. The effective questionnaire response rate reached 100.00% in both rounds of consultation. Suggestions were put forward by 80.00% and 33.33% of experts in the first and second round, respectively, indicating high attention and active participation in this

research.The expert authority coefficient (Cr) was > 0.800 in both rounds, demonstrating high authority and credibility of the expert panel. The Kendall's coefficient of concordance was < 0.500, showing good coordination among expert opinions. For the training objectives, training contents, training methods and assessment methods of the fertility protection training programme for breast surgical nurses caring for patients of childbearing age with breast cancer, the importance scores were greater than 4, the coefficients of variation were less than 0.200, and the full-mark rates of most indicators exceeded 70%, suggesting that expert opinions tended to converge.The development process of the fertility protection training programme for breast surgical nurses caring for patients of childbearing age with breast cancer was relatively complete. The programme is scientifically sound and reliable, and can provide guidance for standardized fertility protection training for breast surgical nurses.

Targeting the clinical characteristics of breast surgical nursing and the practical difficulties in implementing fertility protection care for patients of childbearing age with breast cancer, this study developed a fertility protection training programme for breast surgical nurses by fully considering the reproductive health needs of domestic patients of childbearing age with breast cancer and the context of clinical diagnosis and treatment services. Centered on basic reproductive physiology, the impacts of comprehensive breast cancer treatment on fertility, an overview of fertility protection and preservation, advances in the clinical application of fertility preservation techniques, specialized nursing practice for fertility protection and preservation, and reproductive health management for patients of childbearing age with breast cancer, the programme takes standardized nurse–patient communication models and clinical intervention procedures as key guarantees. It conforms to the standardized training programme for oncology specialist nurses[38], and features the specialty of coordinated fertility protection care integrated into breast cancer diagnosis and treatment in breast surgery.Basic reproductive physiology and the effects of comprehensive breast cancer treatment on fertility serve as important theoretical foundations for conducting clinical fertility assessment, health education and early interventions, enabling nurses to build systematic cognition of reproductive health. As the key frontier training components, the overview of fertility protection and preservation and advances in the clinical application of fertility preservation techniques can guide nurses to accurately identify eligible patients, optimal intervention timing and technical risks, and standardize fertility assessment, health guidance and multidisciplinary referral. Specialized nursing practice for fertility protection and preservation and reproductive health management for patients of childbearing age with breast cancer constitute the core practical modules. The combined training mode of lectures, case analysis and scenario simulation helps improve nurses' clinical practical competence and care quality.Meanwhile, fertility protection involves sensitive reproductive privacy issues of patients. Clinically, nurses tend to be cautious in relevant communication and lack initiative in service provision[31]. This programme guides nurses in communication practice to ensure the orderly delivery of fertility protection nursing services. The training programme can compensate for the deficiencies of breast surgical nurses in knowledge and communication skills regarding fertility protection for breast cancer patients, help alleviate the insufficient provision of fertility-related education and supportive services in clinical practice[31], and

gradually improve breast surgical nurses' capacity to deliver fertility protection services for patients of childbearing age with breast cancer.

Educational and training approaches including scenario simulation[39], online learning platforms based on learning application software[40], and blended learning[41] have achieved favourable outcomes in standardized training for nurses. Considering the specialty characteristics and training effectiveness of fertility protection training for breast surgical nurses caring for patients of childbearing age with breast cancer, this programme formulated targeted training methods. Theoretical modules adopt lectures combined with online resource learning to strengthen nurses' knowledge foundation. For practical modules, a multi-modal training approach integrating lectures, online resource learning, scenario simulation, and case analysis is applied to focus on improving nurses' practical skills, risk assessment ability, specialized thinking and comprehensive analytical capacity.Assessment is an important method to test training quality, and assessment methods should correspond to training approaches. Apart from the combined assessment of theoretical examination and standardized patient scenario simulation, this training programme also uses the *Knowledge-Attitude-Practice Scale of Fertility Protection for Breast Surgical Nurses* for the core module of specialized nursing practice in fertility protection and preservation. Objective data can be used to reflect whether nurses' knowledge, attitudes and practice related to fertility protection are improved after training. The programme adopts diverse training and assessment methods. While standardizing fertility protection training, it emphasizes the cultivation of nurses' clinical practical skills. Combined subjective evaluation and objective data can jointly reflect the improvement of breast surgical nurses' competency in providing fertility protection for patients of childbearing age with breast cancer.

Limitations and future directions

Although this study developed a relatively comprehensive training programme, several limitations remain. First, despite the rigorous Delphi process adopted in this study, the training programme still needs to be validated through practical application research. Second, all Delphi experts were recruited from tertiary hospitals in China; the applicability of this programme for breast surgical nurses working in primary hospitals requires further evaluation. Future research may conduct interventional empirical studies to implement the programme in in-service training for breast surgical nurses and evaluate its effects on improving nurses' knowledge, attitude and practice regarding fertility protection. Meanwhile, the programme can be revised according to the conditions of different medical institutions, and supporting teaching materials such as courseware and teaching cases can be developed to enrich training resources.

Declarations

Acknowledgements

The authors express their sincere gratitude to all participants involved in this study.

Author contributions

Qi Wang, Cancan Chen and Pei Zhao contributed to the study's conception and design, acquisition of data, analysis, and interpretation of data, drafted the article and revised it for content. Hongmei Zhang and Pilei Si reviewed it and approved the final version for publication.

Funding

2024 Annual Project of Medical Science and Technology Research Program of Henan Province (SBGJ202403005);

Open Project of Henan Provincial Key Laboratory of Nursing Medicine in 2025 (HNSYHLKT202503)

Open Project of Henan Provincial Key Laboratory of Nursing Medicine in 2023 (HNSYHLKT202302)

Data availability

The datasets generated and analyzed during the current study are not publicly available due to privacy and ethical restrictions, but are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Henan Provincial People's Hospital on 30 May 2024 (approval no. Lun Shen. (2024). (116)). This study complied with the principles of the Declaration of Helsinki. All the participants provided written informed consent and participated anonymously.

Clinical trial number

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

1 Henan Provincial People's Hospital, Zhengzhou, China

References

1. SUNG, H,FERLAY J,SIEGEL R, L, et al. Global Cancer Statistics 2020:GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in185 countries[J]. CA Cancer J Clin.

2021;71(3):209–49.
2. MILLER K D,FIDLER-BENAOUDIA M, KEEGAN T, H, et al. Cancer statistics for adolescents and young adults,2020[J]. CA Cancer J Clin. 2020;70(6):443–59.
3. HAN B F, ZHENG R S, ZENG H M et al. Cancer incidence and mortality in China, 2022[J]. J Natl Cancer Cent 2024,4(1):47–53.
4. SUN LEVN, FENTON J. Impact of the 21-Gene Recurrence Score Assay on the Treatment of Estrogen Receptor-Positive, HER2-Negative, Breast Cancer Patients With 1–3 Positive Nodes: A Prospective Clinical Utility Study[J]. Clin Breast Cancer. 2022;22(1):e74–9.
5. UMASHANKAR, S,LI M,BLEVINS, K, et al. Characterizing attitudes related to future child-bearing in young women diagnosed with earlystage breast cancer[J]. Breast Cancer Res Treat. 2024;204(3):509–20.
6. TURNBULL A K,PATEL S,MARTINEZ-PEREZ, C, et al. Risk of chemotherapy-related amenorrhoea(CRA)in premenopausal women undergoing chemotherapy for early stage breast cancer[J]. Breast Cancer Res Treat. 2021;186(1):237–45.
7. Lambertini M, Blondeaux E, Bruzzone M et al. Pregnancy After Breast Cancer: A Systematic Review and Meta-Analysis[J].J CLIN ONCOL,2021,39(29): 3293–305.
8. Professional Committee on Fertility Preservation of the China Maternal and Child Health Care Association. Chinese Expert Consensus on Clinical Practice of Female Fertility Preservation [J]. Chin J Reprod Contracept. 2021;41(5):383–91. [In Chinese].
9. Shi YB, Shao XG. Investigation on the Current Awareness of Both Patients and Doctors in Dalian Regarding Sperm Preservation for Young Cancer Patients [J]. J Reprod Med. 2019;28(01):80–4. [In Chinese].
10. Liu YX, Ma JR, Chen HL et al. Analysis of the current situation and intervention effects of fertility preservation in young breast cancer patients [J/OL]. Shanghai Med, 1–14 [2026-01-03].[In Chinese].
11. Paluch-Shimon S, Cardoso F, ,Partridge A et al. ESO–ESMO 4th International Consensus Guidelines for Breast Cancer in Young Women (BCY4)[J]. Annals of Oncology,2020,31(6): 674–96.
12. KIEU V, STERN C. Australian fertility preservation guidelines for people with cancer 2022: review and recommendations [J]. Med J Aust. 2022;217(11):564–9.
13. King L, Quinn GP, Vadaparampil ST, et al. Oncology nurses'perceptions of barriers to discussion of fertility preservation with patients with cancer[J]. Clin J Oncol Nurs. 2008;12(3):467–76.
14. Loren AW, Mangu PB, Beck LN, et al. Fertility preservation for patients with cancer:American Society of Clinical Oncology clinical practice guideline update [J]. J Clin Oncol. 2013;31(19):2500–10.
15. Ye Y, Chen A, Liu Z. Investigation on the Awareness of Sperm Preservation among Hospital Staff and Its Influencing Factors [J]. J Reprod Med. 2020;29(12):1603–11. [In Chinese].
16. Shi Y, Gao XY, Zhang FZ, et al. The current status and influencing factors of nurses in maternal and child specialized hospitals' cognition towards fertility preservation for cancer patients [J]. Henan Med Res. 2023;32(7):1205–10. [In Chinese].

17. CAMPBELL A G, HILLEMEIER M. Fertility counseling information adequacy as a moderator of regret among adolescent and young adult breast cancer survivors[J]. Support Care Cancer 2021,29(5):2689–97.
18. Brown K, Armstrong N, Potdar N. Fertility preservation decisions in young women with breast cancer: a qualitative study of health care professionals' views and experiences. HUM FERTIL. 2021;25(5):903–11.
19. Xiao Y, Li J, Lei J, et al. Experiences of doctors and nurses offering fertility guidance to young breast cancer patients: A qualitative study. EUR J ONCOL NURS. 2023;68:102470.
20. ANAZODO A, LAWS P. The development of an international oncofertility competency framework: a model to increase oncofertility implementation[J]. Oncologist. 2019;24(12):e1450–9.
21. Vadaparampil ST, Hutchins NM, Quinn GP. Reproductive health in the adolescent and young adult cancer patient: an innovative training program for oncology nurses. J CANCER EDUC. 2013;28(1):197–208.
22. Vadaparampil ST, Gwede CK, Meade C, et al. ENRICH: A promising oncology nurse training program to implement ASCO clinical practice guidelines on fertility for AYA cancer patients. PATIENT EDUC COUNS. 2016;99(11):1907–10.
23. Quinn GP, Bowman Curci M, Reich RR, et al. Impact of a web-based reproductive health training program: ENRICH (Educating Nurses about Reproductive Issues in Cancer Healthcare). Psycho-oncology. 2019;28(5):1096–101.
24. Vadaparampil ST, Christie J, Bowman M, et al. Nurse perspectives on referrals for oncology patients to reproductive endocrinologists: results of a learning activity. J Contin Educ Nurs. 2016;47(8):376–84.
25. Winterling J, Lampic C, Wettergren L. Fex-talk: a short educational intervention intended to enhance nurses’ readiness to discuss fertility and sexuality with cancer patients. J Cancer Educ Off J Am Assoc Cancer Educ. 2020;35(3):538–44.
26. Ono M, Harada M, Horie A, et al. Effect of a web-based fertility preservation training program for medical professionals in Japan. INT J CLIN ONCOL. 2023;28(9):1112–20.
27. Qu P. Investigation on the Knowledge, Attitude and Practice of Oncology Nurses Regarding Cancer Patients' Fertility Preservation and Construction of Training Program [D]. Anhui University of Chinese Medicine; 2025. [In Chinese].
28. Yuan X, Li J, Zhang N, Peng J, Yang X, Li W. Fertility preservation in young breast cancer patients: A nationwide survey on knowledge, attitudes, and practices among breast surgical healthcare providers in China. Breast. 2025;81:104426.
29. Nardin S, Arecco L, Delucchi V, et al. Physicians' knowledge, practice, and attitudes on fertility and pregnancy-related issues in young women with advanced breast cancer: results of the ABC6 and ABC7 survey. Breast. 2025;82:104479.
30. Lei J, Li JH, Lin Q, et al. Summary of the best evidence for fertility guidance for young breast cancer patients [J]. Chin J Nurs. 2022;57(18):2268–75. [In Chinese].

31. Sun MY, Lu QY, Zhang PY, et al. Analysis of Obstacles and Demands for Medical Staff in Assisting Breast Cancer Patients in Making Fertility Protection Decisions [J]. China Nurs Manage. 2025;25(03):375–80. [In Chinese].
32. Altmann J, Dimitrova D, Stark E, Einsiedel N, Heistermann L, Sehouli J. Improving future care: the role of oncofertility education in medical curricula in Germany. Results of a nationwide survey of 346 medical students. Arch Gynecol Obstet. 2026;313(1):187. Published 2026 Apr 29.
33. Niederberger M, Schifano J, Deckert S, Hirt J, Homberg A, Köberich S, Kuhn R, Rommel A, Sonnberger M. Delphi studies in social and health sciences-Recommendations for an interdisciplinary standardized reporting (DELPHISTAR). Results of a Delphi study. PLoS ONE. 2024;19(8):e0304651.
34. Wang Q, Zhao P, Zhang HM, et al. Research on the current situation and influencing factors of reproductive information needs of women with breast cancer during childbearing age [J]. Chin J Mod Nurs. 2025;31(2):223–7. [In Chinese].
35. Dijkstra NE, De Baetselier E, Dilles T, Van Rompaey B, da Cunha Batalha LM, Filov I, et al. Developing a competence framework for nurses in pharmaceutical care: a Delphi study. Nurse Educ Today. 2021;104:104926.
36. Huang SJ, Zhong MN, Cai YD, et al. Construction of evaluation index system for core competence of clinical nutrition specialist nurses [J]. Chin J Nurs. 2020;55(11):1665–72. [In Chinese].
37. Chang YL, Zhang YW, Yan YY, et al. Construction and verification of an evaluation index system for core competence of nurses specialized in assisted reproductive technology [J]. Chin J Nurs. 2024;59(23):2833–40. [In Chinese].
38. Tang GJ, Xu BL, Hong JH et al. A training program and its practice for oncology specialized nurses based on core competence cultivation[J]. Chin J Nurs 2016,51(4):467–70.[In Chinese].
39. Li WF, Li M, Sun SB et al. Visual analysis of the application status and trend of scenario simulation teaching in nursing field in China in the past decade[J]. China Med Her 2021,18(22):33–6.[In Chinese].
40. Liu JF, Gong X,Liu YJ. The application of online learning platform in the pre-job training of new nurses[J]. Chin J Nurs Educ 2018,15(7):500–3.[In Chinese].
41. Li YC, Gao J, Yang L et al. The application of blended teaching in theoretical training of new nurses[J]. Chin J Nurs Educ 2019,16(10):746–50.[In Chinese].