

Effect of nursing precision Health intervention on psychological distress and self-perceived burden in patients undergoing in vitro fertilization-embryo transfer

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Abstract: Objective To evaluate the effect of a precision nursing intervention based on the Nursing Science Precision Health (NSPH) model on psychological distress and self-perceived burden in patients undergoing in vitro fertilization-embryo transfer (IVF-ET), and to explore its impact on fertility knowledge level and quality of life. **Methods** This study was conducted in a public tertiary reproductive hospital in Guangxi Zhuang Autonomous Region. A total of 80 female patients undergoing IVF-ET were recruited and randomly divided into a control group (N=40) and an experimental group (N=40) using a random number table method. The control group received routine nursing care, while the experimental group received an additional NSPH model-based precision psychological health intervention for 3 months. Patients' levels of psychological distress, self-perceived burden, fertility knowledge, and quality of life were assessed at baseline and 3 months after the intervention. **Results** After 3 months of intervention, the Distress Thermometer (DT) scores and Self-Perceived Burden Scale (SPBS) scores in the experimental group were significantly lower than those in the control group (all $P < 0.05$). The Fertility & Infertility Treatment Knowledge Score (FIT-KS) scores and all dimensions of the Fertility Quality of Life (FertiQoL) scale in the experimental group were also significantly better than those in the control group (all $P < 0.05$). **Conclusion** The precision nursing intervention based on the NSPH model can effectively reduce the level of psychological distress and self-perceived burden, and simultaneously improve fertility-related knowledge and quality of life in IVF-ET patients. This intervention provides evidence-based support for improving mental health outcomes in patients undergoing IVF-ET. [Guofeng Wu, Mengjie Li, Yanmei Li, Ping Zhu, Qifang Tang, Ni Luo, Zhaohui Jiang. **Effect of nursing precision Health intervention on psychological distress and self-perceived burden in patients undergoing in vitro fertilization-embryo transfer.** *Biomedicine and Nursing* 2026;12(3):1-10]. ISSN 2379-8211 (print); ISSN 2379-8203 (online). <http://www.nbmedicine.org>. 01. doi:[10.7537/marsbnj120326.01](https://doi.org/10.7537/marsbnj120326.01)

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Introduction

In vitro fertilization-embryo transfer (IVF-ET) is one of the most commonly used assisted reproductive technologies for treating infertility. Although this technique has achieved significant progress in clinical pregnancy rates, patients undergoing IVF-ET generally face high levels of psychological stress throughout the entire treatment cycle [1-2]. Studies have shown that approximately 20%–50% of IVF-ET patients experience significant psychological stress symptoms such as anxiety and depression, and some patients have varying degrees of self-perceived burden [3-4]. Psychological distress refers to unpleasant emotional experiences triggered by psychological, social, and spiritual factors, including both normal feelings such as worry and frustration, as well as clinical symptoms such as fear, anxiety, and depression [5]. It not only affects patients' physical and mental health and treatment adherence but may also adversely affect embryo implantation and pregnancy outcomes through neuroendocrine mechanisms [6-7]. Therefore, taking effective measures to alleviate psychological distress

and reduce self-perceived burden in IVF-ET patients is of great clinical significance.

At present, psychological nursing interventions for IVF-ET patients mainly consist of routine psychological support or health education [8], lacking precise identification and matching of individual differences and dynamic patterns of psychological changes. The timing of interventions is often focused on a fixed point in the treatment cycle, failing to adequately consider the fluctuating characteristics of psychological distress over time [9]. This may lead to patients with high levels of psychological distress not receiving sufficient intervention intensity, while those with low levels may receive unnecessary intervention, thereby affecting the overall intervention effect.

The Nursing Science Precision Health (NSPH) model emphasizes the development of precise prevention, assessment, and intervention strategies based on individuals' biological, behavioral, social, and environmental characteristics [10-11]. This model has been preliminarily applied in areas such as precision disease management and clinical decision-making [12], but its

application in the field of assisted reproductive nursing remains limited. The core of precision nursing lies in “the right patient, the right time, and the right intervention,” which requires researchers to first identify the heterogeneous trajectories of patients’ psychological problems and the key time windows.

Our research group previously conducted a prospective longitudinal study on the trajectories of psychological distress in IVF-ET patients. The study found that the detection rate of psychological distress among IVF-ET patients was as high as 61%. Using latent class growth mixture modeling, the psychological distress trajectories of patients were classified into three groups: low, moderate, and high psychological distress levels. Notably, the psychological distress level in all groups peaked at one month after embryo transfer and gradually decreased thereafter with extended follow-up time. This finding suggests that one month after embryo transfer is a critical window for psychological intervention, and patients with different trajectory categories may require precisely tailored intervention intensities.

Based on the findings of our preliminary study, this study used the NSPH model as a guide to construct a precision psychological health intervention program for IVF-ET patients. Through a randomized controlled trial, we evaluated the effects of this program on patients’ psychological distress, self-perceived burden, fertility-related knowledge level, and quality of life, aiming to provide evidence-based support for optimizing psychological nursing practice in IVF-ET patients.

1. Methods

1.1 Participants

A convenience sampling method was used to recruit 80 patients undergoing in vitro fertilization-embryo transfer at a reproductive hospital in Guangxi Zhuang Autonomous Region from October 2025 to March 2026. The inclusion criteria were as follows: (1) female patients diagnosed with infertility and receiving IVF-ET treatment; (2) aged 20 to 50 years; (3) a score of ≥ 4 on the Distress Thermometer^[13]; (4) ability to use a smartphone normally and having normal understanding and communication skills; (5) voluntary participation in this study and signed written informed consent. The exclusion criteria were: (1) development of major complications during assisted reproductive treatment; (2) history of psychiatric disorders or presence of severe mental disorders; (3) visual or hearing impairments that prevented receiving health education through new media technology; (4) currently participating in other interventional studies or psychological interventions. This study was approved by the Reproductive Medicine Ethics Committee of the Guangxi Zhuang Autonomous Region Reproductive Hospital (KY-LL-2024-034). The study complied with

the Declaration of Helsinki, and written informed consent was obtained from all participants.

1.2 Procedures

The sample size was estimated using the formula for two-sample means: $N1 = N2 = 2[(t_{\alpha/2} + t_{\beta})S/\delta]^2$. A two-sided $\alpha = 0.05$ and $\beta = 0.1$ were set, giving $t_{\alpha/2} = 1.96$ and $t_{\beta} = 1.282$. Based on the pilot study, $S = 5.337$ and $\delta = 4.8$. The calculation yielded $N1 = N2 = 26$ participants per group. Considering a 20% attrition rate, at least 66 participants were required, and the final total sample size was determined to be 80. The 80 eligible participants were randomly assigned to either the control group or the experimental group using a random number table method, with a 1:1 allocation ratio, resulting in 40 participants per group. Random allocation was performed by a researcher who was not involved in participant recruitment. The random numbers, corresponding codes, and group assignments were written on allocation cards and placed in sequentially numbered opaque envelopes (1 to 80) in the order generated by the random numbers, each containing the participant’s group allocation.

1.3 Interventions

1.3.1 Control Group

Participants in the control group received routine nursing care, which included the following components: (1) Pre-treatment phase: Electronic health management records were established; the responsible nurse provided oral health education to participants and their spouses, and distributed assisted reproductive health knowledge brochures and question-and-answer handbooks covering disease knowledge, treatment procedures, medication guidance, and daily life guidance (diet, exercise, lifestyle, etc.). (2) Treatment cycle phase (including trigger, oocyte retrieval and sperm collection, embryo transfer, luteal support, and pregnancy confirmation): Routine basic nursing care, specialized nursing care, and general psychological support were provided, and precautions for each step were explained. (3) Post-treatment and follow-up phase: A follow-up handbook was provided upon discharge, clearly indicating the next follow-up appointment; an assisted reproduction specialized nurse conducted telephone follow-ups once a month through the follow-up system platform to inquire about and document the patient’s diet, emotional status, exercise, and daily living conditions, and provided professional guidance.

1.3.2 Experimental Group

In addition to the routine nursing care, participants in the experimental group received a precision psychological health intervention program based on the NSPH model delivered through a mobile health management platform. The intervention lasted for 3 months. The specific contents and implementation were as follows. (1) A precision nursing team was established, consisting of one senior chief physician

from the reproductive medicine department, one psychologist, one head nurse, four specialized nurses from the reproductive medicine department, and one information technology engineer. All members received uniform training and passed an assessment before implementing the intervention.(2) Based on the NSPH model framework, the precise phenotypes of IVF-ET patients were analyzed to identify high-risk factors and trajectory categories of psychological distress. Team members reviewed authoritative domestic and

international literature, combined clinical practice with expert consultations, and developed a draft of the precision nursing program based on the NSPH model. One senior chief physician and two associate chief nurses from the reproductive medicine department reviewed the draft and conducted a pilot study, leading to the final version of the intervention program.(3) The precision psychological health intervention was implemented through the mobile health management platform. The detailed contents are presented in Table 1.

Table 1. Implementation content of the intervention measures in the experimental group

Phase	Intervention module	Specific measures	Frequency / Duration
①Pre-treatment phase	Spouse-synchronized cognitive restructuring	a. During the patient's hospital visit, team members conducted face-to-face interviews with the couple on a one-to-one basis and distributed electronic questionnaires through the physical and mental health management platform to understand the couple's basic information, disease cognition, psychological status, and treatment expectations. b. Both spouses were encouraged to express themselves and received face-to-face precise health education. Educational videos were played and questions were answered to help the couple change their negative perceptions of the disease. c. After the interview, the patient and spouse were invited to join the platform management group and follow the hospital's official health education WeChat official account and video channel.	First visit; 15~20min
	Behavioral goal setting	a. Push pictures, texts and micro-videos (1-3 min each) via the health management platform every Tuesday and Friday during home stay; b. Hold online live lectures on reproductive health and mental health once a month; c. Encourage patients to write a "Diary of pregnancy preparation" recording daily diet, sleep status, activity content, psychological state, etc., and provide feedback and small gifts.	Twice weekly push; Live lectures 1-2 times per month
②Post-support phase	Health monitoring and symptom management	a. Monitor physiological indicators, somatic symptoms, and psychological health status; conduct regular postoperative follow-up through the health management platform to record patients' pregnancy status and psychological state. b. Invite patients to regularly complete mental health questionnaires and upload data; team members dynamically adjust the intervention based on the data.	Weekly assessment, adjusted as needed
	Psychological support	Build a cloud platform for psychological support to provide online counseling services (identifying stressors, emotional reactions and cognitive biases); push online courses; set up a mutual Q&A zone for professional answers.	Provided on demand; courses pushed once a week
	Family and social support	Organize online support group activities and peer exchange meetings (inviting successful patients to share experiences); encourage discussion and expression, reward active participants; real-time communication and feedback.	Peer exchange meeting once a month

1.4 Data Collection and Outcome Measures

Two trained researchers evaluated the intervention effects using standardized questionnaires and uniform instructions at baseline (before intervention) and at 3 months after intervention. The specific assessment tools were as follows.

1.4.1 General Information Questionnaire:

A self-designed questionnaire was used to collect sociodemographic and disease-related information, including age, marital status, place of residence, educational level, employment status, monthly household income, family type, duration of infertility, and history of miscarriage.

1.4.2 Distress Thermometer

The Distress Thermometer (DT), recommended by the National Comprehensive Cancer Network (NCCN), was employed to assess participants' level of psychological distress at different time points. This instrument is a single-item self-report scale scored on an 11-point scale from 0 to 10, where 0 indicates "no distress" and 10 indicates "extreme distress." A score below 4 is considered within the range of normal emotional fluctuation, while a score of 4 or higher indicates moderate to severe psychological distress, with higher scores reflecting more severe distress. The DT was introduced and validated in the Chinese population by Zhang et al.^[13], who reported a sensitivity of 0.80 and a specificity of 0.70.

1.4.3 Self-Perceived Burden Scale (SPBS)

The SPBS, developed by Cousineau et al.^[14], comprises 10 items grouped into three dimensions: physical, emotional, and economic factors. Responses are collected using a 5-point Likert scale, with total scores ranging from 10 to 50. Higher scores indicate a greater level of self-perceived burden. The scale demonstrated good internal consistency, with a Cronbach's alpha coefficient of 0.85. Total scores can be classified into four grades: 40–50 indicates severe burden, 30–39 moderate burden, 20–29 mild burden, and 10–19 little to no burden.

1.4.4 Fertility & Infertility Treatment Knowledge Score (FIT-KS)

This questionnaire is used to assess fertility knowledge in the general population and medical

professionals, covering knowledge related to natural fertility and infertility treatment. This study adopted the Chinese version translated by Ai Yinhui et al.^[15]. The questionnaire consisted of 27 items across 3 dimensions, with a total score of 27. Higher scores indicated better knowledge mastery. The overall Cronbach's α coefficient of the questionnaire was 0.908, and the test-retest reliability was 0.851, indicating good reliability and validity.

1.4.5 The Fertility Quality of Life (FertiQoL) Scale

This scale contains 36 items and consists of two parts: the Core module and the Treatment module. The Core module (24 items) covers four domains: emotional, mind/body, relational, and social. The Treatment module (10 items) covers two domains: treatment environment and treatment tolerability. Each item is rated on a Likert 5-point scale ranging from 0 to 4, and the total score is converted to a range of 0 to 100. Higher scores indicate better quality of life^[16].

1.5 Statistical Analysis

Statistical analysis was performed using SPSS version 26.0. Continuous variables conforming to a normal distribution were described as (Mean $\pm$ SD). Intergroup comparisons were conducted using independent samples t-tests, and intragroup comparisons were conducted using paired t-tests or paired rank sum tests. Categorical variables were described as frequencies and percentages (n, %), and intergroup comparisons were performed using the chi-square test or rank sum test. The significance level was set at $\alpha = 0.05$ (two-tailed). A $P < 0.05$ was considered statistically significant for all hypothesis tests.

2 Results

2.1 Comparison of General Information

A total of 80 participants were included in this study and divided into an experimental group (n = 40) and a control group (n = 40). All patients completed the intervention. There were no statistically significant differences in baseline data between the two groups ($P > 0.05$), as shown in Table 2.

Table 2. Comparison of general information between the two groups

Characteristics	experimental group (N=40)	control group (N=40)	t / χ^2	P value
Age (y)	35.67±5.37	34.78±6.10	-0.700 ^a	0.486
marital status			0.621	0.431
First marriage	32 (80.0)	29 (72.5)		
Remarriage	8 (20.0)	11 (27.5)		
Characteristics	experimental group (N=40)	control group (N=40)	t / χ^2	P value
Residence			0.457	0.499
City	24 (60.0)	21 (52.5)		
Rural	16 (40.0)	19 (47.5)		
Educational attainment			2.481	0.289
Junior high school and below	6 (15.0)	8 (20.0)		
High school	10 (25.0)	15 (37.5)		
University and above	24 (60.0)	17 (42.5)		
Working condition			0.457	0.499
In-service	24 (60.0)	21 (52.5)		
Jobless	16 (40.0)	19 (47.5)		
Household monthly income (Chinese yuan)			0.854	0.652
<3000	7 (17.5)	9 (22.5)		
3000~5000	19 (47.5)	15 (37.5)		
>5000	14 (35.0)	16 (40.0)		
family type			1.257	0.262
Living with parents	16 (40.0)	21 (52.5)		
Couples live together	24 (60.0)	19 (47.5)		
Infertility time (years)	3.80±1.21	3.56±1.09	-0.918 ^a	0.362
history of miscarriage			1.003	0.317
Yes	9 (22.5)	13 (32.5)		
No	31 (77.5)	27 (67.5)		

a, t statistic;

2.2 Comparison of Distress Thermometer Scores Between the Two Groups

Intragroup comparison showed that DT scores in both groups decreased after the intervention compared with baseline ($P < 0.05$). Intergroup

comparison showed that DT scores in the experimental group were significantly lower than those in the control group after the intervention, and the differences were statistically significant ($P < 0.05$), as shown in Table 3.

Table 3. Comparison of DT scores between the two groups (score, $\bar{x} \pm s$)

Group	N	Pre-intervention	post-intervention	Z value	P value
experimental	40	6.68±1.94	3.73±1.39	-4.495	<0.001
control	40	6.93±1.68	5.80±1.55	-3.136	0.002
t value		0.615	6.279		
P value		0.540	<0.001		

2.3 Comparison of Self-Perceived Burden Scale Scores Between the Two Groups

Intragroup comparison showed that the Self-Perceived Burden Scale (SPBS) scores in both groups decreased after the intervention compared with baseline

($P < 0.001$). Intergroup comparison showed that the SPBS scores in the experimental group were significantly lower than those in the control group after the intervention, and the differences were statistically significant ($P < 0.001$), as shown in Table 4.

Table 4. Comparison of SPBS scores between the two groups (score, $\bar{x} \pm s$)

Group	N	Pre-intervention	post-intervention	Z /t value	P value
experimental	40	31.05±3.49	22.55±3.21	11.515 ^a	<0.001
control	40	29.98±3.06	26.47±3.74	-3.726	<0.001
t value		-1.462	5.025		
P value		0.148	<0.001		

2.4 Comparison of Fertility & Infertility Treatment Knowledge Scores Between the Two Groups

Intragroup comparison showed that the FIT-KS in the experimental group increased significantly after the intervention compared with baseline ($P <$

0.001). Intergroup comparison showed that the FIT-KS in the experimental group was significantly higher than that in the control group after the intervention, and the differences were statistically significant ($P < 0.05$), as shown in Table 5.

Table 5. Comparison of FIT-KS between the two groups(score, $\bar{x} \pm s$)

Group	N	Pre-intervention	post-intervention	Z /t value	P value
experimental	40	15.70±3.39	20.07±2.79	11.775 ^a	<0.001
control	40	16.90±3.03	17.55±3.59	-1.733	0.083
t value		1.667	-3.507		
P value		0.099	0.001		

2.5 Comparison of Fertility Quality of Life Scale Scores Between the Two Groups

Intragroup comparison showed that the FertiQoL scores in the experimental group increased significantly after the intervention compared with

baseline ($P < 0.001$). Intergroup comparison showed that the FertiQoL scores in the experimental group were significantly higher than those in the control group after the intervention, and the differences were statistically significant ($P < 0.05$), as shown in Table 6.

Table 6. Comparison of FertiQoL scores between the two groups (score, $\bar{x} \pm s$)

Group	N	Pre-intervention	post-intervention	Z value	P value
experimental	40	67.85±11.90	73.27±9.67	-3.665	<0.001
control	40	66.12±9.74	68.07±10.28	-1.291	0.197
t value		-0.709	-2.329		
P value		0.480	0.022		

3. Discussion

This study is the first to apply the Nursing Science Precision Health model to the psychological nursing care of patients undergoing IVF-ET. Through a randomized controlled trial, we evaluated the effects of a precision intervention program based on this model on patients' psychological distress, self-perceived burden, fertility-related knowledge level, and quality of life. The results showed that, compared with routine nursing care, the NSPH model-based precision nursing intervention significantly reduced the level of psychological distress and self-perceived burden, and simultaneously improved fertility-related knowledge and fertility-related quality of life in IVF-ET patients.

Regarding psychological outcomes, this study found that after 3 months of intervention, the Distress Thermometer scores and Self-Perceived Burden Scale scores in the experimental group were significantly lower than those in the control group, with statistically significant differences ($P < 0.05$). This result suggests that the NSPH model-based precision nursing intervention can effectively alleviate psychological distress and reduce self-perceived burden in IVF-ET patients. Possible reasons for this finding are as follows. First, the intervention program was grounded in the core concepts of the NSPH model, emphasizing "precise phenotyping" and "stratified matching intervention." Our research group's previous longitudinal study identified three heterogeneous trajectories of psychological distress in IVF-ET patients (low, moderate, and high levels), with the peak of psychological distress occurring one month after embryo transfer. Based on this, the current intervention

program provided individualized cognitive restructuring and behavioral goal setting during the pre-treatment phase, and strengthened health monitoring and psychological support during the post-support phase, thereby matching intervention intensity with patients' needs. Second, the intervention program placed particular emphasis on spousal synchronous participation and family support. Relevant studies have shown that psychological distress in IVF-ET patients stems not only from the uncertainty of the treatment itself but also from insufficient spousal support and poor couple communication [17-18]. In this study, the "spouse-synchronized cognitive restructuring" module in the pre-treatment phase enabled both spouses to jointly understand disease knowledge and adjust cognitive biases, helping to form a consistent psychological coping strategy and thereby alleviating patients' self-perceived burden. Furthermore, peer exchange meetings and online support groups during the post-support phase provided patients with external social support, enhanced their sense of belonging, and further reduced psychological distress levels [19-20]. Compared with previous studies, KOUMPAROU et al. [21-22] reported that psychological support interventions had limited effects on alleviating anxiety and depression in IVF-ET patients, possibly because those interventions lacked precise understanding of the dynamic changes in patients' psychological states. In contrast, based on the critical window of "one month after embryo transfer" identified from our longitudinal data, the current study strengthened health monitoring and psychological support during the post-support phase, which may have

more effectively captured the optimal timing for intervention.

Regarding knowledge level and quality of life, this study found that after the intervention, the Fertility & Infertility Treatment Knowledge Score and the total score of the Fertility Quality of Life scale in the experimental group were significantly higher than those in the control group ($P < 0.05$), while the improvements in the above indicators in the control group were not significant. This indicates that the NSPH model-based precision nursing intervention can not only alleviate negative psychological states but also effectively enhance patients' disease-related knowledge level and their overall fertility-related quality of life. The improvement in FIT-KS scores may be attributed to the multi-format, multi-channel health education strategies used in the intervention program. The intervention delivered fertility and infertility treatment-related knowledge through various formats, including pictures and texts, micro-videos, online live lectures, and a mutual Q&A zone. Moreover, all content was reviewed by a multidisciplinary team to ensure accuracy and comprehensibility^[23-24]. At the same time, patients could repeatedly view the pushed content according to their own needs, and this flexible learning approach facilitated knowledge absorption and internalization. In contrast, the health education provided in routine nursing care consisted mainly of oral instruction and paper-based handbooks, which offered limited information and lacked subsequent reinforcement^[25]. The improvement in the total FertiQoL score can be explained by the overall effects of the intervention. The intervention program improved patients' overall quality of life through multiple pathways, including alleviating psychological distress, reducing self-perceived burden, and enhancing disease-related knowledge levels. Furthermore, supportive measures within the intervention, such as spousal synchronous participation, peer exchange meetings, and real-time online counseling, may have enhanced patients' social support and treatment confidence, thereby contributing positively to the overall improvement in quality of life^[18, 26]. This intervention program enabled real-time communication between patients and the nursing team through a mobile health management platform, allowing patients to receive professional guidance in a timely manner. This "readily accessible" support may help enhance patients' sense of control and treatment confidence, thereby improving their overall quality of life.

This study has several limitations. First, the sample size was relatively small and derived from a single center, which limits the generalizability of the findings. Second, the intervention duration was three months, and the long-term maintenance of the intervention effects, particularly the impact on eventual

pregnancy outcomes, was not observed. Third, the assessment of psychological distress and self-perceived burden relied on patient self-report scales, which may introduce reporting bias. Future research should conduct multicenter, large-sample randomized controlled trials, extend the follow-up period, and include pregnancy outcomes as objective endpoint measures for validation.

4 Conclusion

The NSPH model-based precision nursing intervention can effectively reduce the level of psychological distress and self-perceived burden, while simultaneously improving fertility-related knowledge and quality of life in IVF-ET patients. This intervention program provides evidence-based support for improving mental health outcomes in patients undergoing IVF-ET.

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