International Journal of Women's Health

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

In vitro Fertilization-Embryo Transfer Patients with Alexithymia and Its Influencing Factors: A Potential Profile Analysis

Yuying Yan, Lidan Xu, Ya Ma, Yuehong Lv, Yuan Jiang

Department of Reproductive Endocrinology, the Affiliated Obstetrics and Gynecology Hospital of Zhejiang University School of Medicine, HangZhou, Zhejiang, People's Republic of China

Correspondence: Yuying Yan, Department of Reproductive Endocrinology, the Affiliated Obstetrics and Gynecology Hospital of Zhejiang University School of Medicine, HangZhou, Zhejiang, 310006, People's Republic of China, Tel +8613750882607, Email yanyuying@zju.edu.cn

Purpose: This study aims to explore the classification characteristics of alexithymia in patients undergoing in vitro fertilization-embryo transfer (IVF-ET) and analyze the differences among these classifications in female patients, in order to alleviate the patients' alexithymia and improve their mental health and reproductive quality of life.

Methods: A total of 385 patients undergoing IVF-ET were selected through convenience sampling from the Reproductive Endocrinology Clinic of a Grade III A-level obstetrics and gynecology hospital in mainland China between June 2024 and December 2024. Data collection included the general information survey form, the Toronto Alexithymia Scale, and the General Self-efficacy Scale. Latent profile analysis was used to explore the potential categories of alexithymia among patients receiving IVF-ET treatment. Univariate and multiple logistic regression analyses were conducted to identify the factors correlated with the potential profiles.

Results: The alexithymia in patients receiving IVF-ET treatment was categorized into three potential groups: low-risk (48.0%), moderate-risk (46.0%), and high-risk alexithymia groups (6.0%). Multiple logistic regression analysis results indicated that educational level, average monthly household income, and self-efficacy are correlated with alexithymia in patients receiving IVF-ET treatment ($P < 0.05$).

Conclusion: The alexithymia in patients receiving IVF-ET treatment can be categorized into three potential profile types. The clinical medical staff should consider the characteristics of patients and implement targeted interventions for those with lower levels of education, lower average monthly household income, and poorer self-efficacy, in order to reduce the degree of alexithymia.

Plain Language Summary: This study aimed to understand how patients undergoing in vitro fertilization-embryo transfer (IVF-ET), struggle to identify and express their emotions (alexithymia) and find ways to improve their mental health and quality of life. From June to December 2024, 385 IVF-ET patients were recruited from a Chinese gynecology hospital, and researchers used questionnaires to gather information on their personal background, emotional recognition ability, and self-confidence. The data analysis showed that patients' alexithymia could be categorized into low-risk (48%), moderate-risk (46%), and high-risk (6%) groups, and that lower education level, less family income, and lower self-confidence were associated with a higher likelihood of alexithymia in patients. As such, medical staff should consider patients'personal situations and provide special care and support to those with lower education, income, and self-confidence in an effort to assist them in better managing emotions and potentially enhancing their mental well-being.

Keywords: *In vitro* fertilization-embryo transfer, alexithymia, self-efficacy, latent profile analysis, influencing factors

Introduction

Infertility is defined as the inability of a couple to conceive despite engaging in regular, unprotected sexual intercourse (without any contraceptive measures) for at least 12 months after marriage or cohabitation.[1,2] Recognized by the World Health Organization as a global public health issue, infertility has become the most significant disease threatening human

Received: 8 July 2025
Accepted: 21 November 2025
Published: 6 December 2025

reproductive health, ranking third only after cancer and cardiovascular and cerebrovascular diseases.[3–5] With rapid modern socioeconomic development, rising work pressure, a fast-paced lifestyle, delayed childbearing age, and unhealthy lifestyle habits such as staying up late and alcohol abuse, the global prevalence of infertility continues to increase. According to research statistics, approximately 48.5 million couples worldwide have experienced infertility, with prevalence rates around 16% in developed countries and as high as 25% in developing countries, indicating an increasing trend over time.[6]

In vitro fertilization-embryo transfer (IVF-ET) is a widely used assisted reproductive technology that offers a safe and effective treatment for infertility. It has brought hope to many patients and their families worldwide.[7] However, infertility is a significant life-stress event for patients and their families, and undertaking IVF-ET treatment requires patients to undergo multiple assisted reproductive technologies. In this process, patients face various pressures and psychological burdens, which are associated with an increased risk of negative emotions such as anxiety, depression, social alienation, self-deprecation, and fear. The incidence of anxiety and depression among patients receiving IVF-ET treatment ranges from 10% to 50%.[8] Studies have indicated that negative psychological stressors such as anxiety and depression can harm the pregnancy outcomes of IVF-ET patients[9] and reduce their quality of life in terms of reproduction.[10] Faced with both physiological and psychological dual pressures and blows, IVF-ET patients have a higher tendency to experience emotional disorders.

Alexithymia, often known as "inability to express emotions" or "affective aphasia", is an emotional disorder characterized by difficulty in identifying feelings (DIF), difficulty in describing feelings (DDF), and externally oriented thinking (EOT).[11] The DIF refer to the inability to distinguish between physical sensations and emotional experiences. The DDF mean it is hard to correctly express one's inner emotions using language. The EOT implies that thinking is rather deliberate and rigid, staying on the external appearance of things, with less attention paid to one's inner emotions.[12] Research indicates that alexithymia is a potential risk factor associated with individuals' physical and mental health and a potential predictor for the development of physical and mental illnesses and psychiatric disorders.[13–15] Additionally, studies have indicated that the occurrence of alexithymia is closely related to depressive mood and feelings of stigma.[16] At present, there is a paucity of research on alexithymia among IVF-ET patients. Notably, existing latent profile analysis related to alexithymia has been predominantly conducted in non-IVF-ET populations such as adolescents and nursing students.[17,18] On the other hand, even in studies focusing on IVF-ET patients including those examining hope levels, anxiety, and depression status the common practice is to only use the overall scale scores of participants for analysis, and similar reliance on total/dimension scores remains the norm in existing alexithymia research on this population.[19–21] The failure to explore alexithymia's latent profiles in IVF-ET patients and thus fully consider the population's heterogeneity is not conducive to clinical healthcare workers taking timely and targeted intervention measures to promote the mental health of these patients.

Latent profile analysis (LPA) is a person-centered statistical approach that categorizes individuals with similar response patterns on observed variables into the same group, effectively segmenting the population into subgroups with different characteristics, which is beneficial for constructing interventions tailored to the various characteristics of these groups.[22] In summary, studying the characteristics and individual-specificity of alexithymia in IVF-ET patients is crucial in the fields of psychological and reproductive health. Given the significance of understanding the unique characteristics of alexithymia in IVF-ET patients, this study employs LPA to explore its potential subcategories, account for patient heterogeneity, and investigate the key correlated factors. This finding aims to provide a reference for constructing targeted intervention plans for different alexithymia classifications in IVF-ET patients, offering guidance for healthcare professionals to develop interventions that may help reduce alexithymia and potentially enhance self-efficacy in these patients.

Materials and Methods

Research Subject

This study was conducted from June 2024 to December 2024 in Zhejiang Province, mainland China. Participants were recruited from a Grade-A tertiary obstetrics and gynecology hospital. The inclusion criteria included married women over the age of 20 (According to Chinese mainland law, which stipulates that the legal marriage age is at least 22 for males and 20 for females) who were undergoing their first IVF-ET cycle. Additionally, participants had to be diagnosed with infertility requiring IVF-ET treatment, possess basic literacy and communication skills, and be able to independently complete the

electronic questionnaire. Patients with a history of severe physical or mental illness were excluded. Studies recommend a minimum sample size of 200 cases for LPA modeling,[23] and our study subjects have fully met this requirement.

Tools

General Information Questionnaire

The general information survey form was designed by the research team and consists of two parts: sociodemographic data and fertility-related information. Sociodemographic data includes age, place of residence, educational level, occupation, average monthly household income, and marital status. Fertility-related information includes the cause of infertility, type of infertility, and duration of infertility, total number of mature oocytes, number of normal fertilizations, number of high-quality embryos (A high-quality embryo was defined based on morphological assessment according to its developmental stage. For cleavage-stage embryos, high quality was defined as 7–9 equally sized blastomeres with ≤10% cytoplasmic fragmentation and no multinucleation. For blastocyst-stage embryos, high quality was defined as a Gardner grade of 3BB or better[24]), and clinical pregnancy statusThe clinical pregnancy rate was 41.6% (A Clinical pregnancy was defined by the presence of a gestational sac in the uterine cavity on transvaginal ultrasound).[25]

The 20-Item Toronto Alexithymia Scale

The scale was revised by Bagby et al[26] in 1994 based on the Toronto Alexithymia Scale (TAS-20)[26] and was adapted to the Chinese cultural context by Yuan Yonggui et al[27] in 2003. The scale consists of 20 items across three dimensions: DIF, DDF, and EOT. Each item is scored using a Likert 5-point scale, ranging from "strongly disagree" to "strongly agree," with scores from 1 to 5. Items 4, 5, 10, 18, and 19 are scored inversely. The total score ranges from 20 to 100, with higher scores indicating more severe alexithymia. A score of 20–50 points indicates no alexithymia, 51–60 points indicates marginal alexithymia, and ≥ 61 points indicates alexithymia. In this study, the Cronbach's α coefficient for the scale is 0.853.

General Self-Efficacy Scale (GSES)

GSES was developed by Professor Schwarzer et al[28] and was translated and revised for the Chinese cultural context by Chinese scholars in 2001.[29] The Chinese version of GSES consists of 10 items, using a Likert 4-point scoring scale, ranging from "completely incorrect" to "completely correct", with scores from 1 to 4. The total score ranges from 10 to 40, with higher scores indicating stronger self-efficacy. The Chinese version of GSES has a Cronbach's α coefficient of 0.87, a test-retest reliability of 0.83, and a split-half reliability of 0.90. In this study, the Cronbach's α coefficient for the scale is 0.943.

Data Collection and Quality Control

The data were collected through a self-reported anonymous online survey platform (Wenjuanxing; https://www.wjx.cn/) on the day of embryo transfer between June 2024 and December 2024. We explained the purpose and significance of the study to the patients and sent them the survey link. The questionnaire indicated that the information collected would be strictly confidential, and patients voluntarily filled out and submitted the questionnaire anonymously after informed consent. We set up the survey to allow only one access per Internet Protocol address to prevent duplicate submissions. To improve the number and quality of valid responses, we required that all questions were mandatory before the survey could be successfully submitted. Among the participants, 5 patients refused to participate in the survey, 3 questionnaires were excluded due to consistent answer choices, and 7 were excluded for being invalid as the response time was less than 120 s. Ultimately, 385 out of 400 patients with infertility submitted valid questionnaires, resulting in an effective response rate of 96.25%. The conduct of this study aligns with the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants.

Statistical Analysis

The LPA of alexithymia in IVF-ET patients was conducted using Mplus software (version 8.3), while Statistical Package for the Social Sciences software (version 27.0) was used for statistical analysis. Profiles of 1–4 were established sequentially for fitting, taking the items of alexithymia as the observed variables. The models were evaluated using the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), sample size-adjusted BIC (aBIC), Entropy, Lo-Mendell-Rubin Test (LMRT), and

Bootstrapped Likelihood Ratio Test (BLRT). Smaller AIC, BIC, and aBIC values indicate a better model fit. The Entropy value ranges from 0 to 1, with an Entropy value of ≥ 0.8 indicating acceptable classification accuracy and a value closer to 1 indicating more precise model classification. BLRT and LMRT were used to determine the fit of the k-class model versus the k-1 class model, with $P < 0.05$ indicating that the k-class model fits better than the k-1 class model.[30,31] Quantitative data following a normal distribution are expressed as mean ± standard deviation, while qualitative data are presented as frequency and percentage (%). Chi-square tests and Fisher's exact probability method were used for intergroup comparisons. For multivariate analysis, variables with statistically significant differences in the univariate analysis were used as independent variables for logistic regression analysis using the optimal results of the latent profile classification as the dependent variable. A significance level of $\alpha = 0.05$ was applied.

Results

Participant Characteristics

A total of 385 IVF-ET patients were included in this study, with an average age of (32.31 ± 3.79) years. The average total number of mature oocytes is (9.84 ± 6.15), the average number of normal fertilizations is (6.89±4.67), and the average number of high-quality embryos is (4.47 ± 2.99). Among them, 150 patients (39.0%) had a bachelor's degree or above, 159 (41.3%) had a family per capita monthly income ranging from 5001 to 10000 yuan, and 337 (87.5%) were in their first marriage, among other detailed information as depicted in Table 1. Additionally, the scores for alexithymia and self-efficacy among IVF-ET patients are presented in Table 2.

Table 1 General Information Survey Table (N = 385)

Variable	Group	Frequency (n)	Percent (%)
Age (years)	<35	274	71.2
	≥35	111	28.8
Residence	City	215	55.8
	Rural	82	21.3
	Town	88	22.9
Educational level	Junior high school or below	66	17.1
	High school or technical secondary school	70	18.2
	Junior college	99	25.7
	Bachelor's degree or above	150	39.0
Occupation	Staying at home	113	29.4
	Part-time job	33	8.6
	Full-time job	239	62.1
Per capita monthly household income (yuan)	≤5000	109	28.3
	5001~10,000	159	41.3
	≥10,000	117	30.4
Marital history	First marriage	337	87.5
	Remarriage	48	12.5
Family living conditions	Couples living alone	236	61.3
	Living with parents	149	38.7
Infertility cause	Female	171	44.4
	Male	60	15.6
	Both sides	79	20.5
	Unexplained cause	75	19.5
Types of Infertility	Primary infertility	213	55.3
	Secondary infertility	172	44.7
Infertility duration	Less than 3 years	179	46.5
	3~5 years	111	28.8
	More than 5 years	95	24.7
Clinical pregnancy	Yes	160	41.6
	No	225	58.4

Table 2 IVF-ET Patients' Alexithymia and Self-Efficacy Scores (N = 385, $x \pm s$)

Items	Score
DIF	18.86 ± 5.84
DDF	13.43 ± 3.13
EOT	22.17 ± 2.83
TAS	54.47 ± 10.00
GSES	24.37 ± 6.42

Table 3 Indicators of Potential Alexithymia Categories in IVF-ET Patients

Model	AIC	BIC	aBIC	Entropy	BLRT(*P*)	LMRT(*P*)	Category Probability			
1	21,382.033	21,540.163	21,413.248							
2	20,031.362	20,272.510	20,078.965	0.893	<0.001	0.008	0.579	0.421		
3	19,249.221	19,573.387	19,313.212	0.912	<0.001	0.027	0.480	0.460	0.060	
4	18,836.529	19,243.713	18,916.908	0.927	<0.001	0.065	0.101	0.366	0.496	0.036

LPA of Alexithymia in IVF-ET Patients

The LPA was conducted using scores from 20 items from the alexithymia scale, with 1–4 models fitted, as detailed in Table 3. When the number of categories was 3, the entropy value was 0.912, and the P-value of the LMRT(P) was statistically significant ($P < 0.05$). When the number of categories was 4, AIC, BIC, and aBIC values decreased, and the entropy value was 0.927, but the P-value of the LMRT(P) was statistically non-significant ($P > 0.05$). Therefore, the model with three categories was selected as the latent profile model for alexithymia in IVF-ET patients. The probabilities of IVF-ET patients belonging to the corresponding latent categories were 0.480, 0.460, and 0.060, respectively, indicating that the model with three latent categories has high reliability. A latent profile plot was drawn based on the classification results of the three latent categories, as detailed in Figure 1.

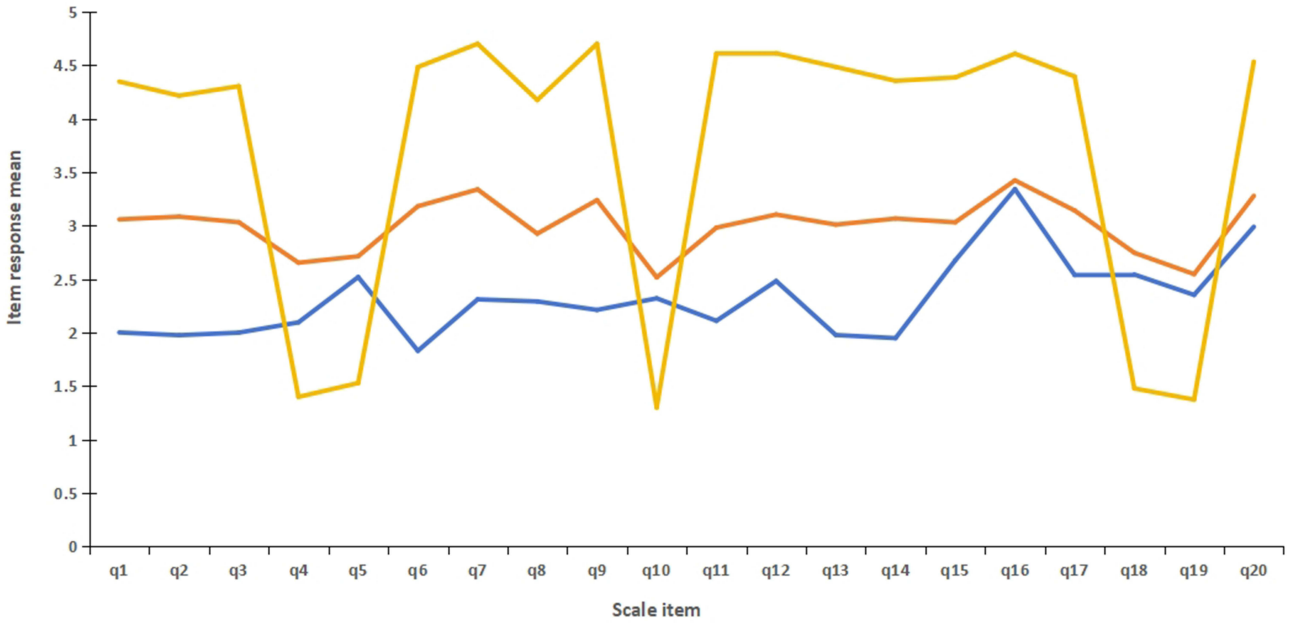

Figure 1 Distribution of characteristics for the three potential categories of alexithymia in IVF-ET patients. Blue represents Group C1 (Low-Risk Alexithymia Group, 48.0%); Orange represents. Group C2 (Medium-Risk Alexithymia Group, 46.0%); and yellow represents Group C3 (High-Risk Alexithymia Group, 6.0%).

https://doi.org/10.2147/IJWH.S552324

Figure 1 depicts the scores for each item of alexithymia across the three categories. Among them, Group C1 consists of 185 cases (48.0%), with IVF-ET patients in this category scoring (46.50 ± 6.51) on the alexithymia scale, which is below the non-alexithymia threshold score of 50 points and overall lower than the other two groups. Consequently, this group of IVF-ET patients is called the "Low-Risk Alexithymia Group." Group C2 consists of 177 cases (46.0%), with IVF-ET patients in this category scoring (60.27 ± 4.51) on the alexithymia scale, which is at the marginal alexithymia threshold of 51–60 points. Hence, this group of IVF-ET patients is named the "Medium-Risk Alexithymia Group." Group C3 consists of 23 cases (6.0%), with the IVF-ET patients in this category scoring (73.96 ± 5.34) on the alexithymia scale, which is higher than the diagnostic threshold for alexithymia of ≥ 61 points and higher than the other two groups. Therefore, this group of IVF-ET patients is named the "High-Risk Alexithymia Group."

From the perspective of the specific differences in items or dimensions among the three groups, Low-Risk Alexithymia Group (n=185, 48.0%): This group showed significantly low scores across all three core dimensions. Key items with the lowest scores included "When I feel distressed, I cannot tell whether it is sadness, fear, or anger" (DIF dimension), indicating that these patients possess strong emotional awareness, can accurately recognize their internal emotional states, and effectively express their feelings through appropriate language. Their EOT dimension scores were also low, reflecting a tendency to focus on internal emotional experiences rather than external events.

Medium-Risk Alexithymia Group (n=177, 46.0%): This group exhibited a heterogeneous pattern with moderate total scores. Specifically, their scores on the EOT dimension were significantly higher than those of the Low-Risk Group (eg, items such as "It is important for me to be aware of my own inner experiences"), indicating a tendency to prioritize external objective events over internal emotional experiences. However, their DIF and DDF dimension scores were close to the overall average, meaning they could still identify their own emotional states and effectively describe emotional experiences to others. This suggests that the alexithymia characteristics of this group are mainly manifested in "externally oriented thinking" rather than comprehensive emotional processing deficits.

High-Risk Alexithymia Group (n=23, 6.0%): This group scored highly on all three dimensions, with particularly prominent elevations in the DIF and EOT dimensions. Key items with the highest scores included "I have some feelings that I find difficult to identify" (DIF dimension) and "It is important for me to recognize my own inner experiences" (EOT dimension). These patients not only struggle to identify their own emotional states but also tend to ignore internal emotional experiences and focus on external objective events, showing comprehensive deficits in emotional recognition, processing, and expression.

Comparison of General Information and Self-Efficacy Characteristics in Different Profiles of IVF-ET Patients

The results of the univariate analysis are depicted in Table 4. There were statistically significant differences in the distribution of the three potential alexithymia profiles based on place of residence ($\chi^2 = 17.454$), educational level ($\chi^2 = 28.789$), occupation ($\chi^2 = 12.518$), and average monthly household income per capita ($\chi^2 = 22.771$; $P < 0.05$).

Multivariate Analysis of the Latent Profiles of Alexithymia in IVF-ET Patients

A multiple logistic regression analysis was conducted to examine the factors associated with the three latent profiles of alexithymia in IVF-ET patients as the dependent variables. The low-risk group of alexithymia was used as the reference group, independent variables were taken based on statistical significance in the univariate analysis, and the self-efficacy score was taken as a covariate. The analysis results are indicated in Table 5. When comparing the "Low-Risk Alexithymia Group" with the "Medium-Risk Alexithymia Group", IVF-ET patients with an educational level of junior high school or below ($OR = 2.649$), high school or secondary vocational school ($OR = 2.126$), and a per capita monthly family income of ≤ 5000 yuan ($OR = 2.460$) were more likely to be in the "Medium-Risk Alexithymia Group" ($P < 0.05$). Patients with a lower score on the self-efficacy scale ($OR = 0.905$) also had a higher likelihood of being classified into the "Medium-Risk Alexithymia Group" ($P < 0.05$).

When comparing the "Low-Risk Alexithymia Group" with the "High-Risk Alexithymia Group", IVF-ET patients with an educational level of junior high school or below ($OR = 6.411$), high school or secondary vocational school ($OR = 6.358$), and a per capita monthly family income of ≤ 5000 yuan ($OR = 4.733$) had a higher likelihood of being classified

Table 4 Comparison of General Information and Self-Efficacy Characteristics in Different Profiles of IVF-ET Patients (N = 385)

Variable	Group	C1 (n=185)	C2 (n=177)	C3 (n=23)	χ^2/F	P
Age(years)	<35	132 (71.4)	124 (70.1)	18 (78.3)	0.674[a]	0.714
	≥35	53 (28.6)	53 (29.9)	5 (21.7)		
Residence	City	121 (65.4)	86 (48.6)	8 (34.8)	17.454[b]	<0.001***
	Rural	26 (14.1)	48 (27.1)	8 (34.8)		
	Town	38 (20.5)	43 (24.3)	7 (30.4)		
Educational level	Junior high school or below	18 (9.7)	41 (23.2)	7 (30.4)	28.789[b]	<0.001***
	High school or technical secondary school	25 (13.5)	37 (20.9)	7 (30.4)		
	Junior college	50 (27.0)	44 (24.9)	5 (21.7)		
	Bachelor's degree or above	92 (49.7)	55 (31.1)	4 (17.4)		
Occupation	Staying at home	41 (22.2)	63 (35.6)	9 (39.1)	12.518[b]	0.011**
	Part-time job	13 (7.0)	19 (10.7)	1 (4.3)		
	Full-time job	131 (70.8)	95 (53.7)	13 (56.5)		
Per capita monthly household income (yuan)	≤5000	35 (18.9)	62 (35.0)	12 (52.2)	22.771[a]	<0.001***
	5001~10,000	78 (42.2)	73 (41.2)	8 (34.8)		
	≥10,000	72 (38.9)	42 (23.7)	3 (13.0)		
Marital history	First marriage	163 (88.1)	154 (87.0)	20 (87.0)	0.209[b]	0.879
	Remarriage	22 (11.9)	23 (13.0)	3 (13.0)		
Family living conditions	Couples living alone	117 (63.2)	104 (58.8)	15 (65.2)	0.926[a]	0.648
	Living with parents	68 (36.8)	73 (41.2)	8 (34.8)		
Infertility cause	Female	83 (44.9)	78 (44.1)	10 (43.5)	2.598[b]	0.865
	Male	31 (16.8)	25 (14.1)	4 (17.4)		
	Both sides	35 (18.9)	41 (23.2)	3 (13.0)		
	Unexplained cause	36 (19.5)	33 (18.6)	6 (26.1)		
Types of Infertility	Primary infertility	102 (55.1)	94 (53.1)	17 (73.9)	3.570[a]	0.171
	Secondary infertility	83 (44.9)	83 (46.9)	6 (26.1)		
Infertility duration	Less than 3 years	94 (50.8)	74 (41.8)	11 (47.8)	3.976[a]	0.409
	3~5 years	48 (25.9)	58 (32.8)	5 (21.7)		
	More than 5 years	43 (23.2)	45 (25.4)	7 (30.4)		
Clinical pregnancy	Yes	87 (53.0)	67 (37.9)	6 (26.1)	5.545	0.062
	No	98 (47.0)	110 (62.1)	17 (73.9)		
GSES scores		26.68 ± 6.19	22.77 ± 5.77	18.09 ± 5.23	33.22[c]	<0.001***

Notes: [a]Chi-square test, [b]Fisher's exact probability method, [c]one-way analysis of variance analysis. **P < 0.05, ***P < 0.001. C1: Low-risk Alexithymia Group, C2: Moderate-risk Alexithymia Group, C3: High-risk Alexithymia Group.

Table 5 Multiple Logistic Regression Analysis of Different Profiles of Alexithymia in IVF-ET Patients

Variables	C2 versus C1						C3 versus C1					
	β	*SE*	wald χ^2	*P*	*OR*	95% *CI*	*β*	*SE*	wald χ^2	*P*	*OR*	95% *CI*
Intercept	1.700	0.635	7.172	0.007			1.940	1.355	2.049	0.152		
Education												
Junior school or lower	0.974	0.397	6.032	0.014	2.649	1.217,5.765	1.858	0.816	5.182	0.023	6.411	1.295, 31.742
High school or vocational school	0.754	0.343	4.821	0.028	2.126	1.084,4.167	1.850	0.747	6.133	0.013	6.358	1.471, 27.481
Junior college	0.355	0.297	1.424	0.233	1.426	0.796,2.554	0.870	0.769	1.280	0.258	2.386	0.529, 10.766
Place of Residence												
City	–0.232	0.290	0.642	0.423	0.793	0.449,1.399	–0.460	0.628	0.537	0.463	0.631	0.184, 2.160
Village	–0.029	0.366	0.006	0.936	0.971	0.474,1.991	–0.301	0.671	0.201	0.654	0.740	0.199, 2.758
Family per capita monthly income (RMB)												
≤5000	0.900	0.313	8.281	0.004	2.460	1.333,4.543	1.554	0.733	4.496	0.034	4.733	1.125, 19.912
5001~10,000	0.340	0.277	1.507	0.220	1.405	0.816,2.419	0.468	0.745	0.394	0.530	1.597	0.371, 6.881
Occupation												
Homemaker	0.286	0.288	0.988	0.320	1.332	0.757,2.342	–0.460	0.628	0.537	0.463	0.631	0.184, 2.160
Part-time job	0.318	0.448	0.503	0.478	1.374	0.571,3.309	–0.301	0.671	0.201	0.654	0.740	0.199, 2.758
Self-efficacy	–0.100	0.020	23.842	<0.001	0.905	0.869,0.942	–0.240	0.048	25.033	<0.001	0.787	0.716, 0.864

Notes: C1: Low-risk Alexithymia Group, C2: Moderate-risk Alexithymia Group, C3: High-risk Alexithymia Group.

into the "High-Risk Alexithymia Group" ($P < 0.05$). Patients with a lower score on the self-efficacy scale ($OR = 0.787$) also had a higher likelihood of being classified into the "High-Risk Alexithymia Group" ($P < 0.05$).

Discussion

This study investigated the current status of alexithymia in 385 IVF-ET patients. Through LPA, these patients were divided into three subgroups, and the influencing factors of alexithymia among different subgroups were explored. This research provides a reliable reference perspective and a valuable basis for the potential targeted reduction of alexithymia in IVF-ET patients.

Analysis of the Current Situation of Alexithymia in IVF-ET Patients

The research results indicate that the alexithymia score of 385 IVF-ET patients is (54.47 ± 10.00), at a medium level, with a positive screening rate of 22.88%. This is similar to the result of (55.53 ± 9.15) obtained by Chinese scholars Luo Mengqian et al[21] in their survey of IVF-ET patients in 2024. However, it is higher than the result of (42.04 ± 10.53) from Alessia et al's survey of Italian patients with infertility in 2020.[10] The differences in the survey results are influenced by multiple factors, which may be associated with the survey time, region, and the population's particularity. Second, compared with patients with infertility who are newly diagnosed in the outpatient department, IVF-ET patients experience more complex physiological pain and negative emotional experiences. Medical staff should pay more attention to assessing alexithymia in IVF-ET patients at different treatment stages and actively adopt targeted intervention measures to prevent or alleviate the occurrence of alexithymia.

This study compared the average scores of each dimension of alexithymia in IVF-ET patients. The order from highest to lowest was EOT, difficulties in emotional recognition, and difficulties in emotional expression, consistent with previous research results.[32] The highest score of EOT indicates that IVF-ET patients focus on external things and lack attention to their inner feelings. This is followed by difficulties in emotional recognition, suggesting that IVF-ET patients have poor ability to distinguish between physical and emotional feelings. Concurrently, infertility involves many family and social issues, and it is related to the patient's privacy, making it difficult for patients to describe their emotions and feelings well. Consequently, medical staff should teach IVF-ET patients with alexithymia to change their deliberate and rigid ways of thinking through scientific and reasonable supportive intervention methods, establish positive psychological coping mechanisms, strengthen their ability to understand their emotional changes, pay attention to emotional experiences, and ultimately improve their core ability to describe and analyze emotions.

The Alexithymia of IVF-ET Patients Can Be Divided Into Three Latent Categories

The research results indicate that among the three potential categories of alexithymia in IVF-ET patients, 185 patients (48.0%) belong to the Low-Risk Alexithymia Group, reflecting a relatively optimistic alexithymia status—these patients can effectively balance life, work, assisted reproductive treatment, and emotional management, and actively cope with various emotional challenges. A total of 177 patients (46.0%) fall into the Medium-Risk Alexithymia Group, suggesting they may face certain difficulties in emotional recognition and expression, which increases their vulnerability to negative emotions such as anxiety, depression, and stigma. The High-Risk Alexithymia Group comprises 23 patients (6.0%), characterized by poor abilities in emotional recognition, description, and externally oriented thinking; the severity of their alexithymia may exert a profound impact on mental health, thereby affecting the overall treatment process and quality of life.

Building on these group-specific characteristics, we further analyzed the clinical significance of these item/dimension-level differences and linked them to the unique traits of IVF-ET patients: The distinct patterns of the three profiles confirm the heterogeneity of alexithymia in this population, a complexity that cannot be fully captured by total scores alone. For instance, the Medium-Risk Group's "expression-specific deficit" may be associated with the pressure of assisted reproductive treatment—patients can recognize their emotional distress but are reluctant or unable to express it due to concerns about treatment outcomes or social stigma. In contrast, the High-Risk Group's comprehensive deficits may reflect deeper psychological vulnerabilities, necessitating more intensive intervention.

These differences provide a foundation for targeted clinical interventions. For the Medium-Risk Group, interventions should focus on improving emotional expression skills (eg, through communication training or narrative therapy). For the

High-Risk Group, priority should be given to enhancing emotional awareness (eg, through mindfulness training or emotional identification exercises) before addressing expression barriers. Compared to uniform strategies based solely on total scores, this tailored approach is more conducive to improving intervention effectiveness.

We acknowledge that the current analysis focuses on core dimensions and key items; future studies could explore item-level response patterns in greater detail (eg, differential item functioning) to further refine the understanding of alexithymia heterogeneity in IVF-ET patients.

Collectively, these findings highlight the need for clinical medical staff to identify the distinct emotional needs of different alexithymia subgroups among IVF-ET patients at an early stage and implement personalized nursing interventions to reduce alexithymia levels.

Influencing Factors of Latent Categories of Alexithymia in IVF-ET Patients

The results of this study indicate a significant association between educational level and alexithymia in IVF-ET patients ($P < 0.05$), with lower educational levels correlating with higher alexithymia scores, consistent with previous research findings.[21,32] A potential explanation for this observed association is that patients with lower educational backgrounds may have relatively limited emotional awareness and cognitive processing skills. When navigating the complex IVF-ET process, they may be less attuned to their internal emotional needs and face challenges in articulating their distress with precise language. These factors may collectively contribute to an elevated likelihood of alexithymia. Notably, as this is a cross-sectional study, no causal relationship can be confirmed. The reasoning above is a tentative interpretation, and it is important to recognize that this association is likely influenced by more plausible mediating factors. For instance, lower educational levels may affect patient-physician communication dynamics, where patients feel less empowered to express concerns.[33] Future research should explore these mediating mechanisms to deepen our understanding. This finding underscores that when medical staff provide counseling, they should tailor interventions to patients' educational backgrounds. For those with lower educational levels, it is crucial to deliver emotion-related health education in accessible language and implement targeted measures. The aim is to enhance their understanding of the IVF-ET process, foster confidence in expressing emotional distress, and thereby mitigate the prevalence and severity of alexithymia.

The results of this study indicate that IVF-ET patients with a family per capita monthly income of fewer than 5000 yuan are more likely to belong to the high-risk group for alexithymia, suggesting that socioeconomic factors are an important risk factor for alexithymia in IVF-ET patients. This is consistent with the findings of related research.[34] Low-income IVF-ET patients not only face the high cost of treatment but may also encounter more issues related to the lack of social resources, including limited access to medical information and social support. This persistent pressure and lack of resources may affect the patients' emotional regulation abilities, increase their psychological burden, making it difficult for them to clearly perceive and express their emotional experiences, thereby increasing the risk of alexithymia. This suggests that medical staff need to pay special attention to IVF-ET patients with poor family economic conditions, proactively assess their psychological status, especially the risk of alexithymia. For high-risk patients, medical staff should develop more precise intervention strategies. At the same time, medical institutions should also actively explore and establish economic assistance and support systems for low-income IVF-ET patients to reduce their financial burden and improve mental health.

Self-efficacy refers to an individual's belief in their ability to take action and achieve specific goals; individuals with high self-efficacy tend to be more confident, inclined to actively solve problems with an optimistic attitude, and better able to adapt to environmental changes, cope with adverse life events, and maintain a positive psychological state.[35] Previous studies have further supported that high self-efficacy can effectively buffer the negative impact of psychological stress on health and improve overall mental health,[36] while conversely, low self-efficacy has been associated with increased alexithymia levels—an association that may affect mental health and potentially form a vicious cycle related to alexithymia.[37] Despite these established links, the differences in self-efficacy among IVF-ET patients with distinct alexithymia profiles remain unclear. Addressing this research gap, the results of this study demonstrate that IVF-ET patients with lower self-efficacy scores are more likely to be classified into the high-risk alexithymia group compared to those in the low-risk and medium-risk groups, which is consistent with previous research findings.[38] This alignment is mechanistically plausible: self-efficacy exhibits significant correlations with positive affect, negative affect, and

depression,[39] and IVF-ET patients with low self-efficacy often struggle with emotional regulation and daily functioning. As negative emotions intensify, their distress tolerance diminishes, further exacerbating alexithymia severity. Clinically, these findings highlight the need for medical staff to provide targeted emotional support, psychological interventions, and family-centered assistance to enhance self-efficacy among IVF-ET patients. Such support can help patients attend to their internal emotional experiences, improve their ability to recognize, describe, and express emotions, and thereby alleviate alexithymia. Furthermore, future research should investigate the interactive effects between self-efficacy and other psychological variables (eg, coping styles, social support) to develop a more holistic psychological intervention model for this population.

The Comparison of Clinical Pregnancy Rates Across the Different Alexithymia Profile Groups

It is noteworthy that this study did not observe a significant association between different potential profiles of alexithymia and clinical pregnancy rates ($P > 0.05$). This negative result suggests that alexithymia may not be a direct predictor of IVF-ET success. The pregnancy outcome of IVF-ET is primarily regulated by complex physiological factors.[40] Psychological traits like alexithymia may have more impact on patients' emotional experiences, treatment adherence, and subjective quality of life, rather than directly affecting biological endpoints.[41] This finding emphasizes the importance of distinguishing between "psychological processes" and "biological outcomes" in reproductive medicine research. Therefore, future research directions should shift towards constructing more complex models to explore how alexithymia acts as a moderating or mediating variable, interacting with other biological and social factors to collectively influence the IVF pathway, rather than considering it as an independent, direct predictor.

Limitations

This study has certain limitations. First, restricted by time and region, it was only conducted in one tertiary-level Grade A obstetrics and gynecology hospital in mainland China. Second, there was inadequate control for potential confounding factors. For instance, research indicates that cortisol levels, a key variable in IVF-ET treatment, can significantly impact patients' emotional states and may act as an important confounder or effect modifier.[42] However, this variable was not collected in our study.

Third, our study is subject to significant selection bias. The sample was restricted to patients undergoing their first IVF-ET cycle who successfully reached the embryo transfer stage. Consequently, the findings cannot be extrapolated to the broader IVF-ET population, especially those who experienced treatment failure or cycle cancellation due to reasons like the absence of viable embryos or complications such as Ovarian Hyperstimulation Syndrome (OHSS). These events are known to have a major psychological impact, and their exclusion is a critical limitation of our work.

In the future, multi-center and cross-regional research with a larger sample size can be incorporated to make the sample more representative. At the same time, key physiological parameters should also be taken into consideration. Additionally, a longitudinal survey method can be adopted to explore the related factors of alexithymia in IVF-ET patients, providing more evidence to promote the mental health development of IVF-ET patients. Simultaneously, it is possible to further explore the intervention measures for different latent categories of alexithymia in IVF-ET patients and pay attention to patients' quality of life and long-term pregnancy outcomes to achieve personalized and precise intervention for alexithymia. Future studies could adopt larger sample sizes, multi-center collaborative designs, or targeted sampling strategies to expand the size of the high-risk alexithymia subgroup. This would help enhance the reliability and generalizability of findings, and further validate the stability of the latent profiles identified in this study.

Conclusion

The level of alexithymia in IVF-ET patients is at a medium level and indicates heterogeneity. It can be divided into three categories: the low-risk alexithymia group, the medium-risk alexithymia group, and the high-risk alexithymia group. Educational level, per capita monthly family income, and self-efficacy are important factors influencing the latent categories of alexithymia in IVF-ET patients. In clinical nursing work, attention should be paid to enhancing the self-

efficacy of IVF-ET patients and improving their emotional experience from the perspective of positive psychology. This will help alleviate the alexithymia of IVF-ET patients, thereby improving their mental health level and the quality of their reproductive life and providing more comprehensive and personalized support during IVF-ET treatment process.

Data Sharing Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to privacy or ethical restrictions.

Ethics Approval and Consent to Participate

The study was carried out in accordance with relevant guidelines and regulations as per Helsinki declaration.The study received approval from the Ethics Committee of the Affiliated Obstetrics and Gynecology Hospital of Zhejiang University School of Medicine (No. IRB-20230216-R), and all participants provided written informed consent before completing the survey.

Acknowledgments

All authors would like to gratitude the patients who completed our investigation in the present study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This research was supported by the Medical Science and Technology Project of Zhejiang Province under Grant NO. 2025KY925 and 2025KY928.

Disclosure

All authors report no conflicts of interest in this work.

References

1. Carson SA, Kallen AN. Diagnosis and management of infertility: a review. *JAMA*. 2021;326(1):65–76. doi:10.1001/jama.2021.4788
2. Zegers-Hochschild F, Adamson GD, Dyer S, et al. The international glossary on infertility and fertility care, 2017. *Hum Reprod*. 2017;32(9):1786–1801. doi:10.1093/humrep/dex234
3. Lawrenz B, Coughlan C, Melado L, et al. Ethnical and sociocultural differences causing infertility are poorly understood-insights from the Arabian perspective. *J Assist Reprod Genet*. 2019;36(4):661–665. doi:10.1007/s10815-019-01411-2
4. Boulet SL, Kawwass J, Session D, et al. US state-level infertility insurance mandates and health plan expenditures on infertility treatments. *Matern Child Health J*. 2019;23(5):623–632. doi:10.1007/s10995-018-2675-y
5. Von Wolff M, Schwartz AK, Bitterlich N, et al. Only women's age and the duration of infertility are the prognostic factors for the success rate of natural cycle IVF. *Arch Gynecol Obstet*. 2019;299(3):883–889. doi:10.1007/s00404-018-5034-8
6. Sykes S, Wills J, Frings D, et al. Multidimensional eHealth literacy for infertility. *Int J Environ Res Public Health*. 2020;17(3):966. doi:10.3390/ijerph17030966
7. Chen M, Heilbronn LK. The health outcomes of human offspring conceived by assisted reproductive technologies (ART). *J Dev Orig Health Dis*. 2017;8(4):388–402. doi:10.1017/S2040174417000228
8. Santa-Cruz DC, Agudo D. Impact of underlying stress in infertility. *Curr Opin Obstet Gynecol*. 2020;32(3):233–236. doi:10.1097/GCO.0000000000000628
9. Boivin J. How does stress, depression and anxiety affect patients undergoing treatment? *Curr Opin Obstet Gynecol*. 2019;31(3):195–199. doi:10.1097/GCO.0000000000000539
10. Renzi A, Di Trani M, Solano L, et al. Alexithymia, infertility-related stress and quality of life in women undergoing an assisted reproductive treatment. *Stress Health*. 2020;36(5):654–662. doi:10.1002/smi.2967
11. Worsley JD, Mansfield R, Corcoran R. Attachment anxiety and problematic social media use: the mediating role of well-being. *Cyberpsychol Behav Soc Netw*. 2018;21(9):563–568. doi:10.1089/cyber.2017.0555
12. Preece DA, Becerra R, Robinson K, et al. What is alexithymia? Using factor analysis to establish its latent structure and relationship with fantasizing and emotional reactivity. *J Pers*. 2020;88(6):1162–1176. doi:10.1111/jopy.12563

13. Han J, Zhang S, Xin L. Latent classes of alexithymia in college students and depressive symptoms, social interaction anxiety. *Chin J Sch Heal*. 2021;42(12):1838–1841.
14. Sun M, Piao M, Jia Z. The impact of alexithymia, anxiety, social pressure, and academic burnout on depression in Chinese university students: an analysis based on SEM. *BMC Psychol*. 2024;12(1):757. doi:10.1186/s40359-024-02262-y
15. Pei C, Fan C, Luo H, et al. Sleep problems in adolescents with depression: role of childhood trauma, alexithymia, rumination, and self-esteem. *J Affect Disord*. 2023;338:83–91. doi:10.1016/j.jad.2023.05.095
16. Zhang H, Wang Y, Lou H, et al. Prevalence of and factors associated with alexithymia among patients with chronic obstructive pulmonary disease in China: a cross-sectional study. *BMC Pulm Med*. 2023;23(1):40. doi:10.1186/s12890-023-02335-5
17. Ni Y, Fang S. Does the Chinese version of 20-item Toronto alexithymia scale (Tas-20-C) measure alexithymia in Chinese young adolescents? Evidence from confirmatory factor analysis, network analysis, and latent profile analysis. *BMC Psy*. 2025;13(1):687. doi:10.1186/s40359-025-03028-w
18. Xiao J, Wu S, Wu M, et al. Latent profile analysis and its influencing factors of alexithymia among nursing students in vocational. *Chin Nurs res*. 2025;39(02):225–230.
19. Ye H, Zhang L, Zhao J, et al. Current situation and influencing factors of hope level in patients with first IVF-ET. *J Reprod Med*. 2025;34(05):595–602.
20. Li N, Bai J, Wang L, et al. Factors influencing the anxiety and depression status in patients undergoing in vitro fertilization-embryo transfer assisted pregnancy. *Sci Rep*. 2025;15(1):16303. doi:10.1038/s41598-025-94247-z
21. Luo M, Wang Y, He Q, et al. Analysis of the current status and influencing factors of alexithymia in women assisting pregnancy through in vitro fertilization-embryo transfer. *J Nurs Sci*. 2024;39(13):6–10.
22. Lönnqvist K, Sinervo T, Kaihlanen AM, et al. Psychosocial work characteristics and sleep quality among early career registered nurses: a cross-sectional latent profile analysis. *BMC Health Serv Res*. 2023;23(1):1020. doi:10.1186/s12913-023-09949-9
23. Nylund KL, Asparouhov T, Muthén B. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. *Struct Equ Model*. 2007;14(4):535–569. doi:10.1080/10705510701575396
24. Working Group on the update of the ESHRE/ALPHA Istanbul Consensus, Coticchio G, Ahlström A, Arroyo G, et al. The Istanbul consensus update: a revised ESHRE/ALPHA consensus on oocyte and embryo static and dynamic morphological assessment†,‡. *Hum Reprod*. 2025;40(6):989–1035. doi:10.1093/humrep/deaf097.107
25. Nelen WL, van der Pluijm RW, Hermens RP, et al. The methodological quality of clinical guidelines of the European society of human reproduction and embryology (ESHRE). *Hum Reprod*. 2008;23(8):1786–1792. doi:10.1093/humrep/den120
26. Bagby RM, Taylor GJ, Parker JD. The twenty-item Toronto alexithymia scale--II. Convergent, discriminant, and concurrent validity. *J Psychosom Res*. 1994;38(1):33–40. doi:10.1016/0022-3999(94)90006-X
27. Yuan Y, Shen X, Zhang X. The reliability and validity of Toronto alexithymia scale (Tas-20). *Sichuan Mental Health*. 2003;16(1):25–27.
28. Schwarzer R, Bäßler J, Kwiatek P, et al. X The assessment of optimistic self-beliefs: comparison of the German, Spanish, and Chinese versions of the general self-efficacy scale. *Applied Psychology*. 1997;46(1):69–88.
29. Caikang W, Zhongfeng H, Yong L. Evidences for reliability and validity of the Chinese version of general self-efficacy scale. *Chin J Appl Psychol*. 2001;7(1):37–40.
30. Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study". *Erratum*. 2008.
31. Raftery AE. Bayesian model selection in social research. *Sociological Methodol*. 1995;25:111–163. doi:10.2307/271063
32. Tang P, Wang JL, Xie WQ, et al. Meta-analysis of the prevalence of alexithymia in elderly Chinese people. *J Evid Based Med*. 2021;21(7):779–786.
33. Lumley MA, Neely LC, Burger AJ. The assessment of alexithymia in medical settings: implications for understanding and treating health problems. *J Pers Assess*. 2007;89(3):230–246. doi:10.1080/00223890701629698
34. Gourounti K, Anagnostopoulos F, Griva F, et al. Alexithymia and fertility-related stress. *Women Health*. 2016;56(3):312–325. doi:10.1080/03630242.2015.1088119
35. Li R, Liu M. The effect of psychological intervention on self-efficacy and coping style of depression patients under medical guidance in colleges and universities. *CNS Spectrums*. 2023;28(S1):S32–S32.
36. Zahed K, Markert C, Sasangohar F. Understanding the role of beliefs on intentions and actual usage of a tool for self-management of mental health among college students. *Appl Ergon*. 2025;126:104485. doi:10.1016/j.apergo.2025.104485
37. Jeung DY, Lee HO, Chung WG, et al. Association of emotional labor, self-efficacy, and type A personality with burnout in korean dental hygienists. *J Korean Med Sci*. 2017;32(9):1423–1430. doi:10.3346/jkms.2017.32.9.1423
38. Li DJ, Wu HC. Mediating effect of emotional symptoms on the association between alexithymia and substance dependence in patients with substance use disorder: the protective role of family support and self-efficacy. *Psychol Res Behav Manage*. 2024;17:3863–3874. doi:10.2147/PRBM.S478305
39. Zhang R, Li X, Luo H, et al. Effect of self-efficacy, disease perception, social support, anxiety, and depression on self-management in young patients with stroke. *J Neurosci Nurs*. 2025;57(2):68–73. doi:10.1097/JNN.0000000000000813
40. Chen X, Chen F, Wu S, et al. Vaginal microbiota alterations under supraphysiological estradiol state during in vitro fertilization-embryo transfer (IVF-ET) and the association with reproductive outcomes. *BMC Microbiol*. 2025;25(1):500. doi:10.1186/s12866-025-04242-7
41. Luminet O, Nielson KA. Alexithymia: toward an experimental, processual affective science with effective interventions. *Annu Rev Psychol*. 2025;76(1):741–769. doi:10.1146/annurev-psych-021424-030718
42. Purewal S, Chapman SCE, van den Akker OBA. Depression and state anxiety scores during assisted reproductive treatment are associated with outcome: a meta-analysis. *Reprod Biomed Online*. 2018;36(6):646–657. doi:10.1016/j.rbmo.2018.03.010