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Decision regret following peripherally inserted central catheter placement in patients with breast cancer: a latent profile analysis

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Abstract

Background

Peripherally inserted central catheters (PICCs) are widely used to deliver chemotherapy in patients with breast cancer. The decision to place a PICC, however, also carries psychological consequences. Decision regret is a negative emotional response to a healthcare decision, arising when patients appraise that decision unfavourably in hindsight. It may compromise patients' quality of life and incline later treatment choices toward undue conservatism. Most existing studies have treated decision regret as a single homogeneous construct, and have therefore overlooked the possibility that patients occupy distinct latent profiles of regret. The present study used latent profile analysis (LPA) to identify subgroups of patients with breast cancer who differ in their patterns of decision regret after PICC placement, and to examine the factors associated with profile membership.

Methods

This cross-sectional study recruited 288 patients with breast cancer undergoing first-time PICC placement by convenience sampling at the Daytime Chemotherapy and Radiotherapy Center of a tertiary hospital in Anhui Province, China, between January and May 2026. Data were collected with a general information questionnaire and five validated instruments: the Decision Regret Scale (DRS), the Decisional Conflict Scale (DCS), the PICC Self-Management Ability Scale, the Treatment Burden Questionnaire (TBQ), and the Social Support Rating Scale (SSRS). LPA was conducted in Mplus 8.3 to identify the latent profiles of decision regret. Multinomial logistic regression examined the factors associated with profile membership, with the low-level regret profile as the reference category. The study was reported in accordance with the STROBE statement.

Results

A total of 263 valid questionnaires were returned, an effective response rate of 91.32%. Three distinct profiles of decision regret emerged: a low-level regret profile (74.50%, n = 196), a moderate-level regret profile (13.70%, n = 36), and a high-level regret profile (11.80%, n = 31). Classification accuracy for this three-profile solution was high (entropy = 0.975). In multinomial logistic regression, five factors were significantly associated with profile membership (all $P < 0.05$): PICC-related complications, decisional conflict, PICC self-management ability, treatment burden, and social support. Compared with the low-level regret profile, the high-level profile showed a higher likelihood of complications (OR = 5.049, P = 0.002) and greater treatment burden (OR = 1.028, P = 0.042), together with lower PICC self-management ability (OR = 0.971, P = 0.021) and lower social support (OR = 0.800, $P < 0.001$). Decisional conflict (OR = 1.044, P = 0.022) and PICC self-management ability (OR = 0.976, P = 0.012) separated the moderate-level profile from the low-level profile.

Conclusions

Decision regret after PICC placement in patients with breast cancer is heterogeneous and falls into three distinct profiles with different clinical characteristics. Patients in the high-level regret profile, marked by complications, higher treatment burden, poorer self-management ability, and limited social support, form a priority group for targeted intervention. Matching vascular access decision support and post-placement care to these profile-specific features may help reduce decision regret and improve the experience of PICC-based chemotherapy.

Background

Breast cancer is the most frequently diagnosed malignancy among women worldwide, with an estimated 2.3 million new cases in 2022, making it the leading cause of female cancer incidence globally [1]. Chemotherapy remains a cornerstone of breast cancer management. Because regimens are prolonged and demand repeated venous access, and because extravasation of vesicant agents can cause severe local tissue injury, a reliable and durable vascular access device is indispensable. PICCs are widely adopted in this population owing to their relative ease of insertion, extended dwell time, and suitability for prolonged infusion [2]. PICC placement, nonetheless, is an invasive procedure. Over a dwell time that may extend to one year, patients are exposed to risks including thrombosis, catheter-related bloodstream infection, occlusion, and malposition. A meta-analysis estimated the incidence of PICC-related thrombosis in patients with breast cancer at 7.0%–12.9% [2]. Beyond these physical complications, patients living with a catheter frequently report anxiety and fear, and the prevalence of kinesiophobia has been reported to be as high as 53.10% [3]. The PICC consequently occupies an ambivalent position in the patient experience. It is at once a prerequisite for safe chemotherapy and a sustained source of physical and psychological burden.

The decision to place a PICC is thus a consequential act within vascular access management, and one that patients may later appraise with ambivalence or self-blame. Decision regret denotes the negative emotional response that arises when an individual evaluates a healthcare decision unfavourably in hindsight. It is characterised by remorse, distress, or self-reproach, and was formalised by Brehaut and colleagues in 2003 through the development of the Decision Regret Scale [4]. Decision regret is clinically consequential rather than a mere subjective inconvenience. It is associated with reduced health-related quality of life, and it may prompt patients to adopt unduly conservative subsequent treatment decisions, thereby attenuating overall therapeutic benefit [5]. The decision to place a PICC unfolds under conditions of uncertainty, as patients weigh the protection of venous integrity against the discomfort and maintenance demands of an indwelling device. It is therefore a plausible but underexamined antecedent of regret.

Research on decision regret in oncology has dealt mainly with surgical and endocrine treatment decisions, and studies centred on vascular access selection remain scarce [6]. In one of the few relevant investigations, Liang et al. reported that decision regret after PICC placement in patients with cancer

was associated with psychological adaptation, treatment burden, and social support. Lower regret was observed among patients who adapted better, carried lighter burdens, and received stronger support [7]. Such studies, however, have generally analysed decision regret as one homogeneous outcome, most often through variable-centred approaches such as mean scores or cut-off thresholds, and they are consequently unable to capture heterogeneity between individuals. This limitation is not trivial. Patients with equivalent average regret scores may still differ qualitatively in how regret is expressed across domains, so that a group mean conceals clinically distinct subgroups with different care needs. Latent profile analysis (LPA) is a person-centred method that identifies unobserved subgroups, or latent profiles, from patterns of responses across observed indicators. It thus reveals population heterogeneity that variable-centred methods obscure [8, 9]. LPA has been increasingly applied in chronic disease and nursing research, but it has rarely been used to examine decision regret among patients living with a PICC.

To address these gaps, the present study used LPA to examine decision regret among patients with breast cancer after first-time PICC placement. By delineating how decision regret is distributed across patients, and what distinguishes those who experience it most intensely, the present study aims to inform the identification of high-risk patients and to support profile-specific strategies within vascular access practice. The specific objectives were:

1. 1. To identify latent profiles of decision regret among patients with breast cancer after PICC placement;
2. 2. To describe the characteristics of each identified profile;
3. 3. To examine factors associated with membership in each profile.

Methods

Study design and setting

This was a cross-sectional survey conducted at the Daytime Chemotherapy and Radiotherapy Center of the First Affiliated Hospital of Anhui Medical University, a tertiary hospital in Hefei, Anhui Province, China, between January and May 2026. The study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies [10].

Participants

Patients were recruited by convenience sampling. Eligibility criteria were: (1) age 18–90 years; (2) pathologically confirmed breast malignancy; (3) first-time PICC placement with an uncomplicated insertion procedure; (4) adequate ability to understand and communicate; and (5) provision of informed consent. Patients were excluded if they (1) had experienced a major stressful life event (e.g., bereavement or marital disruption) within 7 days before enrolment, or (2) had an autoimmune disease or severe impairment of vital organ function (cardiac, pulmonary, or renal). Participants who withdrew

consent during the study, or who discontinued or changed PICC use because of tumour progression or accidental catheter dislodgement, were also excluded from the analysis.

Sample size

Because the primary analysis was LPA rather than estimation of a single population proportion, sample size was determined according to methodological guidance for mixture modelling rather than prevalence estimation alone. Simulation-based evidence indicates that LPA solutions are reasonably recovered when each latent profile contains approximately 50 or more individuals and when entropy is high (≥ 0.80) [11]. Assuming three profiles and a smallest expected profile proportion of approximately 12%, consistent with the reported distribution of decision regret in patients with cancer [7], a total sample of approximately 400 would be required for each profile to exceed 50 cases. Given the constraints of a single-centre study, the study aimed to recruit as many eligible patients as possible during the study period. A total of 288 questionnaires were distributed and 263 valid questionnaires were retained, yielding an effective response rate of 91.32%. The final sample fell somewhat short of the target suggested by the conservative criterion above. Nevertheless, the smallest profile comprised 31 participants, all model fit indices were satisfactory, and entropy was high, suggesting that the three-profile solution was reasonably stable in this sample. This limitation is acknowledged and discussed below.

Data collection

Two research nurses who had received unified training explained the purpose, content, and confidentiality provisions of the study to potential participants. After written informed consent had been obtained, data were collected anonymously through a one-to-one online survey administered via the Wenjuanxing platform. When a participant was unable to complete the questionnaire independently, the research nurse read each item aloud in a neutral manner and recorded the participant's chosen response. Completed questionnaires were reviewed on site and any missing items were completed. After data collection, extreme or implausible values were screened and reviewed. Consequently, the final analytic dataset contained no missing values. The survey response rate and excluded cases are reported above.

Instruments

General information questionnaire. A self-designed questionnaire collected age, education level, marital status, employment status, place of residence, average monthly household income, type of medical insurance, current treatment regimen, disease stage, history of breast cancer surgery, PICC dwell time, and whether PICC-related complications had occurred during the indwelling period.

Decision Regret Scale (DRS). The DRS was developed by Brehaut et al. in 2003 [4] and validated in Chinese by Chen et al. in 2018 [12]. The scale contains five items rated on a 5-point Likert scale (1 = strongly agree to 5 = strongly disagree), with items 2 and 4 reverse-scored. The total score is calculated as (mean item score − 1) × 5, yielding a maximum of 20, with higher scores indicating greater decision regret. The scale has previously been used to assess decision regret regarding PICC placement in patients with cancer [7]. In the present study, Cronbach's α for the DRS was 0.895.

Decisional Conflict Scale (DCS). The DCS was developed by O'Connor in 1995 [13] and validated in Chinese by Wang et al. in 2019 [14]. It assesses the level of decisional conflict experienced when choosing among treatment options and comprises 16 items across three dimensions: uncertainty (3 items), factors contributing to decision-making (9 items), and effective decision-making (4 items). Items are rated on a 5-point Likert scale (0 = strongly agree to 4 = strongly disagree), giving a total score range of 0–64, with higher scores indicating greater decisional conflict. In the present study, Cronbach's α for the DCS was 0.947.

PICC Self-Management Ability Scale. This scale was developed by Liu et al. in 2012 [15] to assess self-management among patients with cancer during PICC indwelling. It contains 35 items across seven dimensions: daily life with the catheter, exercise with the catheter, daily catheter observation, adherence to catheter maintenance, confidence in catheter management, management of abnormal situations, and information acquisition. Items are rated on a 5-point Likert scale (1 = never to 5 = always), giving a total score range of 35–175, with higher scores indicating better self-management ability. Scores were categorised as high (> 140), moderate (105–140), and low (< 105). In the present study, Cronbach's α was 0.916.

Treatment Burden Questionnaire (TBQ). The TBQ was developed by Tran et al. in 2014 [16] and culturally adapted into Chinese by Chin et al. in 2019 [17]. It measures the burden experienced by patients in managing their illness and treatment across four dimensions (medication, clinic visits and follow-up, medically related lifestyle, and health problems) and contains 15 items. Items are rated on a 10-point scale (0 = no burden to 10 = extreme burden), giving a total score range of 0–150, with higher scores indicating greater treatment burden. In the present study, Cronbach's α was 0.902.

Social Support Rating Scale (SSRS). The SSRS was developed by Xiao in 1994 [18] to assess the level of social support. It contains three dimensions: objective support (3 items), subjective support (4 items), and support utilisation (3 items), giving 10 items in total. The total score ranges from 12 to 66, with higher scores indicating better social support. Cronbach's α of the original scale was 0.72.

Statistical analysis

LPA was conducted in Mplus 8.3 to identify latent profiles of decision regret. Models specifying one to four profiles were estimated sequentially, and model fit was compared using the Akaike information criterion (AIC), the Bayesian information criterion (BIC), and the sample-size-adjusted BIC (aBIC), for which lower values indicate better fit. Entropy was used to indicate classification accuracy, with values

above 0.80 considered satisfactory. The Lo–Mendell–Rubin adjusted likelihood ratio test (LMR) and the bootstrap likelihood ratio test (BLRT) were used to compare solutions, with a statistically significant P value indicating that the current solution fitted the data better than the solution with one fewer profile. The optimum number of profiles was determined by jointly considering all fit indices, the interpretability of the profiles, and the adequacy of profile sizes. A minimum of 5,000 random starts and 500 iterations was specified to avoid convergence on local maxima.

Statistical analyses were performed in SPSS 26.0. Internal consistency of each instrument was assessed using Cronbach's α. Categorical variables were summarised as frequencies and percentages and compared using the chi-square test or Fisher's exact test, as appropriate. Continuous variables were summarised as mean ± standard deviation and compared using one-way analysis of variance (ANOVA). Multinomial logistic regression was used to examine factors associated with profile membership, with the low-level regret profile as the reference category. A two-sided P value < 0.05 was considered statistically significant.

Because all data were collected using self-report questionnaires, common method bias (CMB) was assessed using Harman's single-factor test. An unrotated exploratory factor analysis of the variables of interest extracted 17 factors with eigenvalues greater than 1, and the first factor accounted for 19.13% of the variance, below the conventional 40% threshold [19]. Harman's single-factor test is a conservative and relatively insensitive method for detecting CMB [20]. Nevertheless, the variables examined in this study differ substantially in nature, comprising a life-event-related outcome, a decision-related construct, a behavioural capability, a burden measure, and a social resource. The study was also not designed primarily to test a single latent factor. The risk of severe common method bias was consequently considered limited.

Results

Participant flow

Of the 288 patients assessed for eligibility, 25 were excluded or returned invalid questionnaires, leaving 263 participants in the final analysis (effective response rate 91.32%). The flow of participants through the study is presented in Fig. 1.

Latent profiles of decision regret

Using the five DRS items as observed indicators, models specifying one to four latent profiles were estimated, and their model fit indices are presented in Table 1. As the number of profiles increased, the AIC, BIC, and aBIC values decreased, indicating progressively better fit. When the number of profiles increased from two to three, the LMR test reached statistical significance (P = 0.041) and the BLRT was likewise significant (P < 0.001). The three-profile model therefore fitted the data significantly better than the two-profile model. This model yielded an entropy of 0.975, indicating high classification accuracy.

When a fourth profile was specified, the LMR test was no longer statistically significant (P = 0.560), and the additional profile was both small and difficult to interpret. On the basis of the fit indices, parsimony, and interpretability, the three-profile solution was selected as the final model. The estimated class probabilities were 0.745, 0.137, and 0.118, and the mean posterior probabilities for class assignment were high (0.995, 0.997, and 0.969 for profiles 1, 2, and 3, respectively), indicating reliable classification.

Table 1
Model fit indices for latent profile solutions of decision regret (n = 263)

Model	AIC	BIC	aBIC	Entropy	LMR (P)	BLRT (P)	Class probabilities
1	4003.771	4039.493	4007.788	—	—	—	—
2	3149.630	3206.784	3156.056	0.987	< 0.001	< 0.001	0.848 / 0.152
3	2997.790	3076.377	3006.627	0.975	0.041	< 0.001	0.745 / 0.137 / 0.118
4	2885.401	2985.421	2896.648	0.984	0.560	< 0.001	0.768 / 0.068 / 0.091 / 0.072

AIC, Akaike information criterion; BIC, Bayesian information criterion; aBIC, sample-size-adjusted BIC; LMR, Lo–Mendell–Rubin adjusted likelihood ratio test; BLRT, bootstrap likelihood ratio test.

A profile plot based on the DRS item scores of the three profiles is presented in Fig. 2. On the basis of the score patterns, the three profiles were labelled as follows. Profile 1 (C1), comprising 196 participants (74.50%), exhibited a relatively flat response pattern with all item scores below 1.5, markedly lower than those of the other profiles; it was therefore designated the "low-level regret profile". Profile 2 (C2), comprising 36 participants (13.70%), had item scores of approximately 2 to 2.5, intermediate between C1 and C3; it was designated the "moderate-level regret profile". Profile 3 (C3), comprising 31 participants (11.80%), had item scores above 3 for all items, clearly exceeding those of the other profiles; it was designated the "high-level regret profile".

Univariate analysis of factors associated with profile membership

Univariate analysis revealed statistically significant differences among the three profiles in the occurrence of PICC-related complications, decisional conflict, PICC self-management ability, treatment burden, and social support (all P < 0.05). No statistically significant differences were found among the three profiles in education level, marital status, employment status, place of residence, average monthly household income, type of medical insurance, treatment regimen, disease stage, history of breast cancer surgery, or PICC dwell time (all P > 0.05) (Table 2).

Table 2
Univariate analysis of characteristics by decision regret profile (n = 263)

Variable	Overall (n = 263)	Low-level regret (n = 196)	Moderate-level regret (n = 36)	High-level regret (n = 31)	Test statistic	P
Education level, n (%)					—	0.651
Junior high school or below	187 (71.10)	139 (70.92)	23 (63.89)	25 (80.65)		
High school / secondary	36 (13.69)	26 (13.27)	7 (19.44)	3 (9.68)		
College or above	40 (15.21)	31 (15.82)	6 (16.67)	3 (9.68)		
Marital status, n (%)					—	0.828
Without spouse	16 (6.08)	13 (6.63)	1 (2.78)	2 (6.45)		
With spouse	247 (93.92)	183 (93.37)	35 (97.22)	29 (93.55)		
Employment status, n (%)					4.841	0.089
Employed	59 (22.43)	41 (20.92)	13 (36.11)	5 (16.13)		
Not employed	204 (77.57)	155 (79.08)	23 (63.89)	26 (83.87)		
Place of residence, n (%)					1.441	0.486
Urban	117 (44.49)	83 (42.35)	18 (50.00)	16 (51.61)		
Township / rural	146 (55.51)	113 (57.65)	18 (50.00)	15 (48.39)		
Average monthly household income, n (%)					1.921	0.383
< 3000 CNY	127 (48.29)	90 (45.92)	19 (52.78)	18 (58.06)		
≥ 3000 CNY	136 (51.71)	106 (54.08)	17 (47.22)	13 (41.94)		
Type of medical insurance, n (%)					8.641	0.071

Variable	Overall (n = 263)	Low-level regret (n = 196)	Moderate-level regret (n = 36)	High-level regret (n = 31)	Test statistic	P
Urban employee insurance	80 (30.42)	60 (30.61)	15 (41.67)	5 (16.13)		
Urban–rural resident insurance	46 (17.49)	32 (16.33)	4 (11.11)	10 (32.26)		
New rural cooperative medical scheme	137 (52.09)	104 (53.06)	17 (47.22)	16 (51.61)		
Treatment regimen, n (%)					1.051	0.591
Single-modality therapy	75 (28.52)	59 (30.10)	8 (22.22)	8 (25.81)		
Combined therapy	188 (71.48)	137 (69.90)	28 (77.78)	23 (74.19)		
Disease stage, n (%)					—	0.661
Stage I	13 (4.94)	9 (4.59)	2 (5.56)	2 (6.45)		
Stage II	132 (50.19)	103 (52.55)	17 (47.22)	12 (38.71)		
Stage III	110 (41.83)	77 (39.29)	17 (47.22)	16 (51.61)		
Stage IV	8 (3.04)	7 (3.57)	0 (0.00)	1 (3.23)		
History of breast cancer surgery, n (%)					0.851	0.652
Yes	201 (76.43)	150 (76.53)	29 (80.56)	22 (70.97)		
No	62 (23.57)	46 (23.47)	7 (19.44)	9 (29.03)		
PICC dwell time, n (%)					7.991	0.239
< 1 month	51 (19.39)	33 (16.84)	7 (19.44)	11 (35.48)		
1–3 months	97 (36.88)	75 (38.27)	11 (30.56)	11 (35.48)		
4–6 months	89 (33.84)	68 (34.69)	13 (36.11)	8 (25.81)		

Variable	Overall (n = 263)	Low-level regret (n = 196)	Moderate-level regret (n = 36)	High-level regret (n = 31)	Test statistic	P
> 6 months	26 (9.89)	20 (10.20)	5 (13.89)	1 (3.23)		
PICC-related complications, n (%)					20.221	< 0.001
No	213 (80.99)	168 (85.71)	29 (80.56)	16 (51.61)		
Yes	50 (19.01)	28 (14.29)	7 (19.44)	15 (48.39)		
Age, years, mean ± SD	51.85 ± 10.43	51.37 ± 10.86	52.58 ± 9.89	54.03 ± 7.98	0.982	0.378
Decisional conflict, mean ± SD	10.66 ± 10.24	9.04 ± 9.63	15.36 ± 9.06	15.48 ± 12.23	10.392	< 0.001
PICC self-management ability, mean ± SD	149.69 ± 19.03	152.95 ± 17.48	141.56 ± 22.58	138.52 ± 17.46	12.522	< 0.001
Treatment burden, mean ± SD	47.90 ± 20.52	44.76 ± 20.55	54.58 ± 15.89	60.00 ± 19.17	10.272	< 0.001
Social support, mean ± SD	33.39 ± 5.66	34.44 ± 5.13	33.00 ± 5.51	27.16 ± 5.10	26.612	< 0.001

Fisher's exact test was used where any expected cell count was < 5; otherwise, the chi-square test or one-way ANOVA was used, as appropriate. SD, standard deviation; PICC, peripherally inserted central catheter.

Multinomial logistic regression

Multinomial logistic regression identified the occurrence of PICC-related complications, decisional conflict, PICC self-management ability, treatment burden, and social support as factors associated with decision regret profile membership (Table 3). With the low-level regret profile as the reference category, membership in the high-level regret profile was associated with a higher likelihood of PICC-related complications (OR = 5.049, 95% CI 1.858–13.721, P = 0.002) and greater treatment burden (OR = 1.028, 95% CI 1.001–1.056, P = 0.042), and with lower PICC self-management ability (OR = 0.971, 95% CI 0.948–0.996, P = 0.021) and lower social support (OR = 0.800, 95% CI 0.722–0.886, P < 0.001). Membership in the moderate-level regret profile was associated with greater decisional conflict (OR = 1.044, 95% CI 1.006–1.082, P = 0.022) and lower PICC self-management ability (OR = 0.976, 95% CI 0.958–0.995, P = 0.012). Overall, five factors distinguished patients with differing levels of decision regret: PICC-related complications, decisional conflict, self-management ability, treatment burden, and social support.

Table 3
Multinomial logistic regression of factors associated with decision regret profile membership (reference: low-level regret profile)

Variable	Moderate-level vs. low-level regret				High-level vs. low-level regret			
	B	OR	95% CI	P	B	OR	95% CI	P
Intercept	0.746	—	—	0.697	7.169	—	—	0.003
PICC-related complications	0.254	1.289	0.495–3.355	0.603	1.619	5.049	1.858–13.721	0.002
Decisional conflict	0.043	1.044	1.006–1.082	0.022	0.016	1.016	0.970–1.063	0.504
PICC self-management ability	−0.024	0.976	0.958–0.995	0.012	−0.029	0.971	0.948–0.996	0.021
Treatment burden	0.020	1.020	1.000–1.041	0.052	0.028	1.028	1.001–1.056	0.042
Social support	−0.012	0.988	0.917–1.064	0.743	−0.223	0.800	0.722–0.886	< 0.001

B, regression coefficient; OR, odds ratio; CI, confidence interval; PICC, peripherally inserted central catheter.

Discussion

In this cross-sectional study of 263 patients with breast cancer after first-time PICC placement, LPA identified three distinct profiles of decision regret: a low-level regret profile (74.50%), a moderate-level regret profile (13.70%), and a high-level regret profile (11.80%). The three profiles differed in PICC-related complications, decisional conflict, self-management ability, treatment burden, and social support, but did not differ in most of the demographic and clinical characteristics examined. Decision regret after PICC placement accordingly appears to be heterogeneous, and a single average score does not capture it well. The patients who differ in their regret experience can instead be distinguished by a coherent set of modifiable psychosocial and care-related factors.

Decision regret is heterogeneous across patients

The three-profile solution was supported by a high entropy value (0.975) and by statistically significant LMR and BLRT comparisons against the two-profile solution. These findings indicate that patients with breast cancer do not experience decision regret uniformly after PICC placement. Most patients (74.50%) belonged to a low-level regret profile, with a flat and low endorsement of regret across all DRS items. A

smaller group fell into a moderate-level profile (13.70%) or a high-level profile (11.80%), with progressively higher endorsements across the same items. This heterogeneity is consistent with the wider literature, in which decision regret following vascular access procedures in patients with cancer is not a uniform experience [7]. It also fits the growing recognition that variable-centred analyses of decision-related outcomes can obscure clinically meaningful subgroups [8, 9]. Variable-centred studies estimate associations at the level of a single sample mean. The profile structure reported here, by contrast, locates heterogeneity at the level of the patient, and so allows qualitative differences in regret, not merely quantitative ones, to be described.

The clinical relevance of this heterogeneity lies in its distribution. The high-level regret profile was relatively small, yet its members reported regret that was qualitatively distinct and, as discussed below, accompanied by a cluster of adverse circumstances. Identifying such patients from their profile characteristics, rather than from a single regret threshold, may allow scarce supportive care resources to be targeted more efficiently. Because regret was assessed across multiple items rather than as one global rating, the profile structure also indicates that some patients express regret in specific aspects of the catheter experience even when overall regret appears low. Such nuance would remain invisible in a group-mean analysis.

Factors associated with profile membership

PICC-related complications. The occurrence of complications was most strongly associated with membership in the high-level regret profile. PICC-related complications include catheter-related bloodstream infection, thrombosis, phlebitis, and catheter dislodgement. They increase physical suffering and can precipitate treatment interruption, unplanned catheter removal, and additional medical costs [2, 21].

The link between complications and regret is plausibly one of attribution. When a complication occurs, patients may reinterpret the original decision to place a PICC as mistaken, and the objective disruption of treatment reinforces this reappraisal. This account is consistent with evidence that unplanned removal of PICCs in patients with cancer is not uncommon and is driven chiefly by dislodgement, infection, and thrombosis [22]. It also agrees with the observation that complications can erode patients' confidence in the chosen vascular access strategy [7].

For vascular access practice, this finding supports pre-placement risk stratification, rigorous catheter care protocols that reduce preventable complications, and prompt and transparent communication when complications do arise, so that patients do not attribute them solely to their own decision. Notably, the effect of complications on regret was graded rather than absolute. Complications distinguished the high-level from the low-level profile, but not the moderate-level from the low-level profile. A single complication may therefore not generate severe regret on its own, but may do so when it coincides with other burdens.

Decisional conflict. Decisional conflict was associated with membership in the moderate-level profile, but not the high-level profile. This pattern warrants careful interpretation. Decisional conflict refers to the uncertainty experienced when choosing among options, together with the perception of inadequate information or support for the choice [13]. It was elevated in both the moderate- and high-level profiles on univariate analysis, yet it remained independently associated with membership only in the moderate-level profile after adjustment. One plausible reading is that among patients with the most severe regret, the influence of decisional conflict is mediated or superseded by concrete negative experiences, notably complications and treatment burden. This pattern places decisional conflict as a modifiable antecedent rather than a terminal determinant of regret.

Because it arises before or during the decision, it offers a point of leverage that downstream clinical events cannot provide. Decision-making about PICC placement involves weighing the benefits of reliable venous access against the risks of a long-dwelling invasive device, the burden of maintenance, and constraints on daily life [5]. When patients feel unable to express a genuine preference, or believe they were swayed by the recommendations of clinicians or family members, decisional conflict increases [23], and the resulting decision becomes correspondingly more vulnerable to later regret. That this pathway is detectable chiefly in the moderate-level profile suggests that decisional conflict may act as an early determinant: if it is left unaddressed, it gives way to regret driven by subsequent care experiences. Shared decision-making, and the use of decision aids that explicitly compare vascular access options such as catheter type, complication risks, maintenance requirements, and lifestyle implications, are therefore central to reducing decisional conflict before it becomes entrenched [24].

PICC self-management ability. PICC self-management ability was independently associated with membership in both the moderate-level and high-level regret profiles, and was lower in each than in the low-level profile. This finding is consistent with the domain-specific difficulties reported by patients in higher-regret profiles, particularly in exercise with the catheter, information acquisition, and management of abnormal situations. Two mutually reinforcing mechanisms may be at work. First, limited self-management competence predisposes patients to catheter-related problems, and the resulting pain and additional procedures are readily attributed to the original decision to place a PICC, which reinforces regret [25]. Second, cancer treatment-related cognitive impairment can compromise memory and the capacity to learn maintenance skills, further impairing self-management [26]. The formation of self-management behaviour is influenced by factors at several levels, including knowledge, beliefs, social support, and access to care [27].

Interventions that are experiential, and tailored to the patient's health literacy and cognitive status, are therefore likely to be more effective than standard didactic education.

It is also notable that self-management ability was one of only two factors associated with both elevated profiles. The intermediate group, then, is not simply a diluted version of the high-regret group. It shares a distinct, behaviourally grounded pathway to regret. The cross-sectional design cannot establish the direction of the self-management–regret relationship, and the two may reinforce each other over time.

Treatment burden. Higher treatment burden was associated with membership in the high-level regret profile. Treatment burden in this population is multidimensional. It encompasses symptom distress, the demands of maintaining a PICC (including repeated dressing changes, showering restrictions, and travel to the hospital for maintenance), and financial costs [16]. When patients face a heavy and continuous burden of treatment, fewer cognitive resources remain available to appraise information carefully before the decision, which can foster unrealistic expectations about the benefits of a PICC. When the anticipated benefits do not materialise, or when the day-to-day inconveniences of the catheter become salient, patients may attribute the resulting dissonance to the original choice and so experience regret [28].

A high treatment burden can also erode patients' capacity to engage actively in decision-making, which increases the likelihood that the chosen option diverges from their personal values and thus heightens susceptibility to regret. For vascular access practice, this argues for systematically assessing treatment burden before placing a PICC, for giving patients a realistic account of maintenance demands, and for exploring alternatives such as lower-burden access routes or appropriately timed removal when clinically feasible.

Social support. Lower social support was most strongly associated with membership in the high-level regret profile. According to the stress-buffering model, social support mitigates the psychological impact of illness and treatment and promotes adaptive coping [29]. Patients with limited support have less access to information and emotional reassurance about the necessity, risks, and maintenance requirements of a PICC. This increases the uncertainty surrounding the decision and, in turn, the likelihood of regret. Inadequate support may also reduce psychological resilience and self-care behaviours, raising the risk of catheter malposition or infection. These negative experiences then further reinforce regret, creating a self-perpetuating cycle.

Notably, social support was the only factor associated with the high-level profile alone and not the moderate-level profile, and its effect size was the largest observed. This pattern suggests that social support may serve as a particularly important protective resource for the most vulnerable patients, that is, those already contending with complications, heavy treatment burden, and self-management difficulties. A mechanism consistent with this interpretation has been described in a recent cohort, in which uncertainty, psychological resilience, and self-care operated in a chain mediation pathway to influence a treatment-related outcome in patients with breast cancer receiving PICC chemotherapy [30]. Read alongside the other findings, this suggests that the resources surrounding a patient may matter as much as the clinical events the patient experiences.

Clinical implications

Efforts to reduce decision regret in this population should be organised around the profile to which a patient is most likely to belong, rather than delivered uniformly. Across the five factors, a clear structure emerges. Decisional conflict marks the moderate-level profile, while complications, treatment burden, self-management ability, and social support jointly characterise the high-level profile. Two principles

follow from the data. First, decisional conflict emerged as a distinguishing feature of the moderate-level profile, and it is potentially modifiable before catheter placement. Structured decision support during the pre-placement consultation may therefore be particularly valuable for patients who are hesitant, or whose preferences have not been clearly elicited. Decision aids that compare venous access options on complication risk, maintenance burden, and lifestyle impact can help align the chosen device with the patient's values [24].

Second, complications, treatment burden, self-management ability, and social support characterised the high-level profile. Patients who display this cluster should be prioritised for intensive, individualised follow-up. Such patients include those who have already experienced a complication, those who report a heavy treatment burden, those who show low confidence in catheter care, and those who lack a supportive network. Follow-up of this kind might comprise proactive complication surveillance, targeted skills training using experiential or teach-back methods, explicit attention to realistic expectations about catheter maintenance, and linkage to psychosocial or financial support resources. A multidisciplinary vascular access team, integrating clinicians, specialist nurses, and psychologists, is likely to be necessary [31]. These recommendations require prospective evaluation, but they follow directly from the observed profile structure and offer a practical basis for stratified care in vascular access services.

Strengths and limitations

The main strength of this study is the use of a person-centred analytic approach to characterise decision regret after PICC placement. This combination has rarely been examined, and it reveals meaningful heterogeneity that is inaccessible to variable-centred methods. The use of validated instruments, a clearly defined sample, and comprehensive reporting of LPA fit indices further support the credibility of the findings.

Several limitations should be acknowledged. First, the study was conducted at a single tertiary hospital in Anhui Province using convenience sampling, which limits the generalisability of the findings to other populations and settings. Patients treated in a daytime chemotherapy and radiotherapy centre may differ systematically from inpatients, for example in disease stability, and such differences could bias estimates of regret. Second, the sample was smaller than the conservative target derived from simulation-based guidance for LPA, and the smallest profile contained 31 participants. Even though the fit indices and entropy were satisfactory, replication in larger samples is warranted. Third, the cross-sectional design precludes inference about the direction of the associations identified. Regret and its correlates may influence one another over time, and prospective longitudinal studies are needed to clarify temporal ordering and to distinguish stable regret from transient distress. Fourth, all measures relied on self-report, which introduces the possibility of common method bias and social desirability bias. Although Harman's single-factor test did not suggest a serious problem, this test is relatively insensitive, and future studies would benefit from multi-method assessment.

Fifth, decision regret was assessed at a single time point, whereas regret is known to evolve. Repeated measurement would provide a more complete picture of its trajectory. Finally, although the study

examined a range of demographic and clinical variables, other potentially relevant factors were not captured, such as the quality of communication with clinicians, the extent of shared decision-making, and the specific type and severity of complications.

Conclusions

Decision regret among patients with breast cancer after PICC placement is heterogeneous and resolves into three distinct profiles: low-level, moderate-level, and high-level regret. These profiles differ in modifiable factors, namely PICC-related complications, decisional conflict, self-management ability, treatment burden, and social support, and their identification offers a basis for stratified care. Patients in the high-level regret profile constitute a priority group for targeted intervention, and pre-placement decision support may be especially valuable for those at risk of moderate-level regret. Prospective, multicentre studies with larger samples and repeated measures are warranted to confirm these profiles, clarify their temporal stability, and evaluate whether profile-tailored interventions reduce decision regret and improve the experience of vascular access in this population.

Abbreviations

aBIC
sample-size-adjusted Bayesian information criterion
AIC
Akaike information criterion
ANOVA
analysis of variance
BIC
Bayesian information criterion
BLRT
bootstrap likelihood ratio test
CI
confidence interval
CMB
common method bias
DCS
Decisional Conflict Scale
DRS
Decision Regret Scale
LMR
Lo–Mendell–Rubin adjusted likelihood ratio test
LPA
latent profile analysis
OR

odds ratio
PICC
peripherally inserted central catheter
SD
standard deviation
SSRS
Social Support Rating Scale
STROBE
Strengthening the Reporting of Observational Studies in Epidemiology
TBQ
Treatment Burden Questionnaire

Declarations

Ethics approval and consent to participate

The study was approved by the Clinical Technology Application Ethics Committee of the First Affiliated Hospital of Anhui Medical University (Approval No. 2024HLZ054). All procedures were conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants prior to data collection.

Consent for publication

Not applicable.

Availability of data and materials

The datasets generated and analysed during the current study are not publicly available because of institutional policies on patient privacy, but are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

• **Xiaoying Wang**: Conceptualisation, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft.

• **Deqiong Xu**: Investigation, Data curation, Formal analysis, Writing – review & editing.

• **Yunya Dong**: Investigation, Data curation.

• **Cuicui Zhou**: Investigation, Data curation.

• **Lin Liang**: Investigation, Data curation.

• **Xiuyun Han**: Investigation, Validation.

• **Baochi Ou**: Funding acquisition, Resources, Investigation, Validation.

• **Wei Zhang**: Conceptualisation, Methodology, Supervision, Project administration, Writing – review & editing.

All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

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Figures

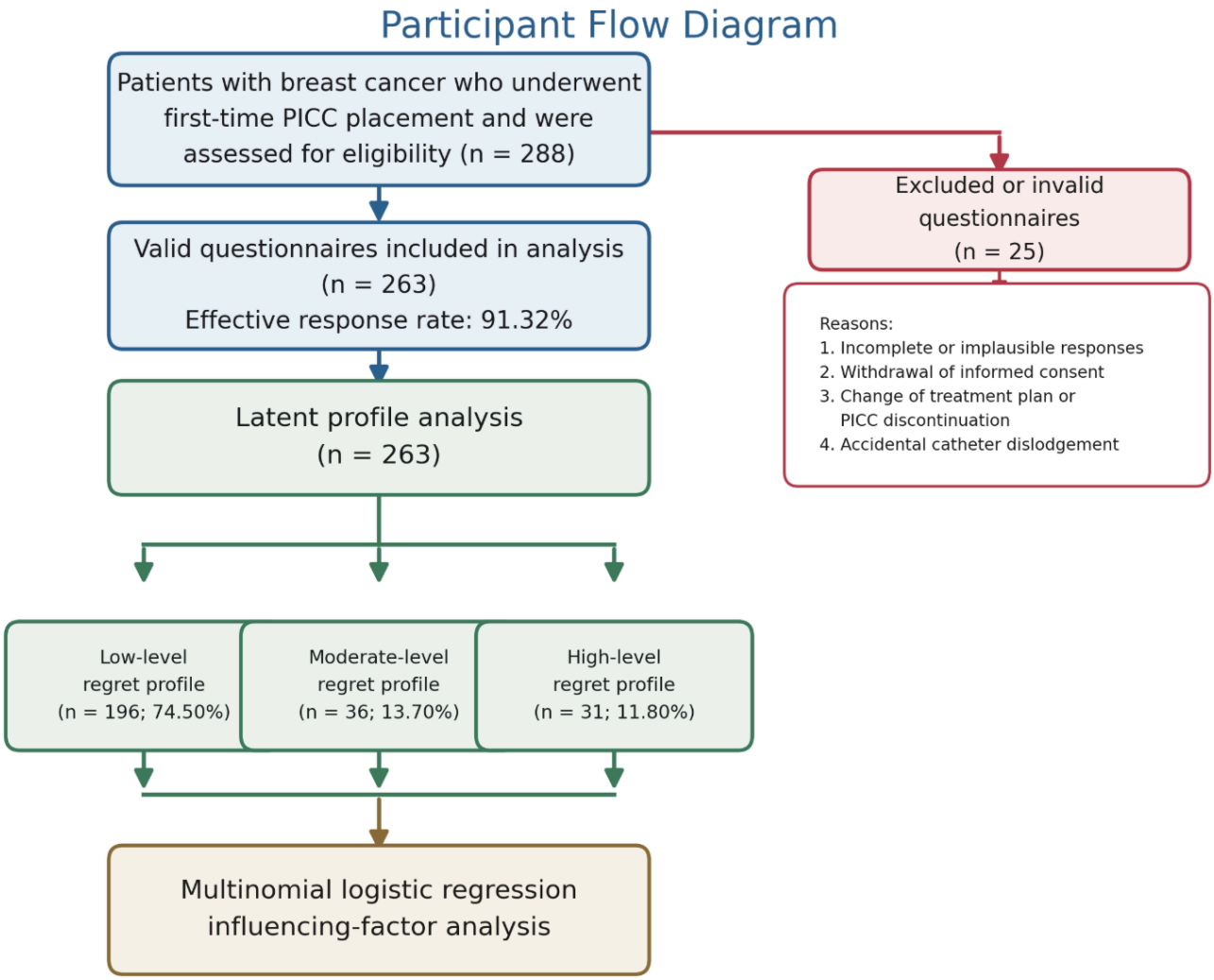


Figure 1

Flow diagram of participant selection and analysis (n = 263). Of 288 patients assessed for eligibility, 25 were excluded or returned invalid questionnaires (incomplete or implausible responses, withdrawal of informed consent, change of treatment plan or PICC discontinuation, or accidental catheter dislodgement); the remaining 263 valid questionnaires were included in the latent profile analysis.

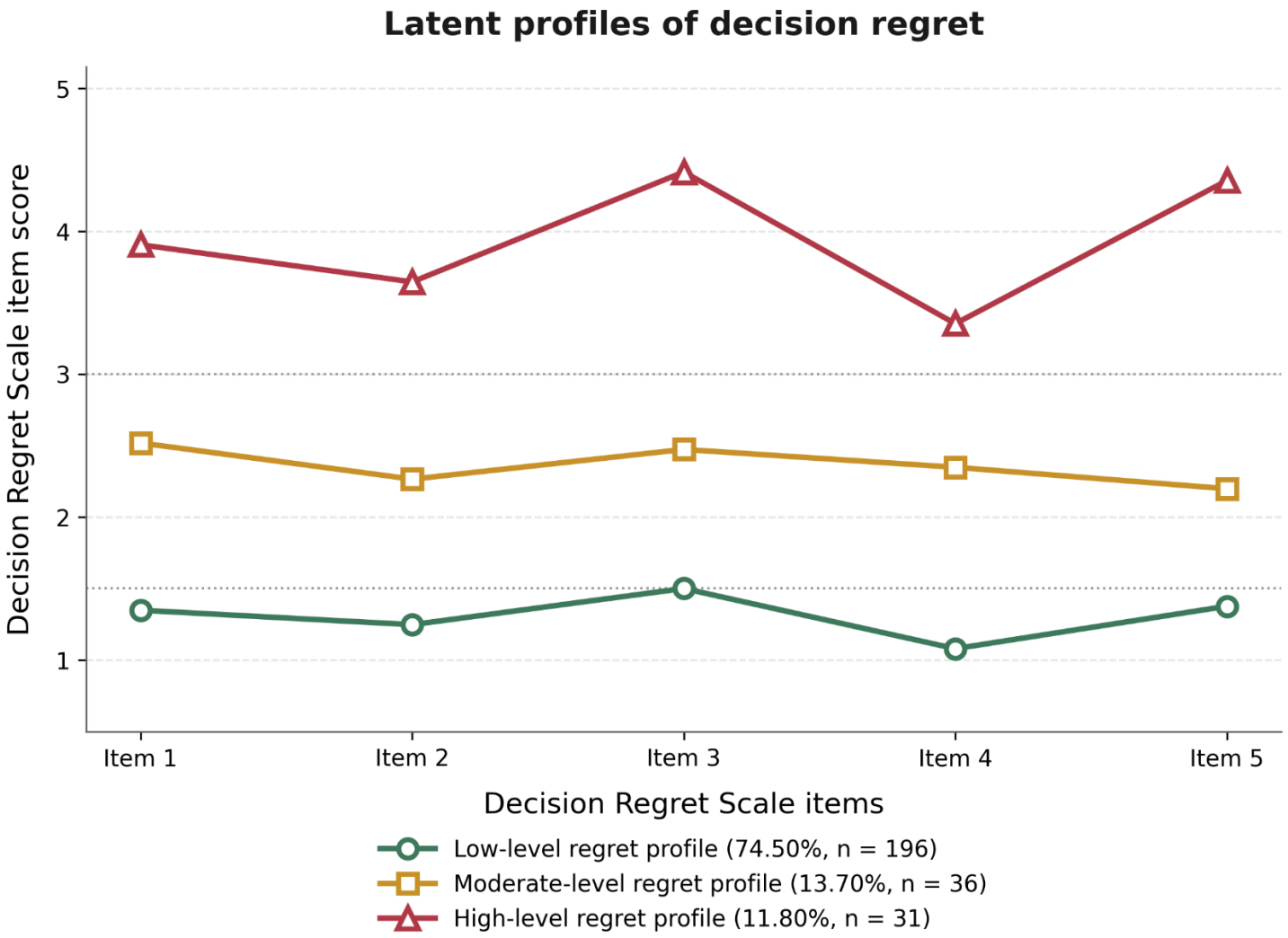


Figure 2

Latent profiles of decision regret among patients with breast cancer after PICC placement (n = 263). The x-axis shows the five items of the Decision Regret Scale, and the y-axis shows item scores. C1, low-level regret profile (74.50%); C2, moderate-level regret profile (13.70%); C3, high-level regret profile (11.80%).