Asia-Pacific Journal of Oncology Nursing 12 (2025) 100648

Contents lists available at ScienceDirect

Asia-Pacific Journal of Oncology Nursing

journal homepage: www.apjon.org

Original Article

Identifying the heterogeneity of self-advocacy in Chinese patients with breast cancer using latent profile analysis and symptom networks

Liping Teng [a,#,*], Yajun Dong [a,#], Yiting Yang [a], Zhou Zhou [a], Jun Sun [a], Teng Wang [b]

[a] Wuxi School of Medicine, Jiangnan University, Wuxi, Jiangsu, China
[b] Department of Oncology, Affiliated Hospital of Jiangnan University, Wuxi, Jiangsu, China

ARTICLE INFO

Keywords:
Self-advocacy
Latent profile analysis
Network analysis
Breast cancer

ABSTRACT

Objective: This study aims to identify subgroups of self-advocacy in patients with breast cancer, assess the heterogeneity among different subgroups, and further delineate symptom networks within each subgroup.
Methods: A cross-sectional survey was conducted among 320 patients with breast cancer in Wuxi, China, from September 2023 to March 2024, who completed questionnaires about their demographic and clinical characteristics, the M.D. Anderson Symptom Inventory, and the Female Self Advocacy in Cancer Survivorship scale. Latent profile analysis was conducted to identify subgroups of self-advocacy. Multinomial logistic regression was employed to reveal the heterogeneity of each subgroup in demographics and clinical characteristics. Network analysis was performed to unveil the network structure of clinical symptoms within each subgroup.
Results: Three subgroups were identified: "Profile 1: low self-advocacy", "Profile 2: moderate self-advocacy", and "Profile 3: high self-advocacy". Compared with patients in Profile 3, those in Profile 1 and Profile 2 showed a higher tendency to have more severe symptoms. Network analysis further revealed that "lack of appetite" emerged as the core symptom in Profile 1, while the core symptom in Profile 2 and Profile 3 was "distress".
Conclusions: Patients in different subgroups manifest individualized self-advocacy. The severity of clinical symptoms might serve as an important risk factor for those with low levels of self-advocacy. Conducting symptom networks of diverse subgroups can facilitate tailored symptom management by focusing on core symptoms, thereby enhancing the effectiveness of interventions and improving patients' self-advocacy and overall quality of life.

Introduction

In 2022, over 2.3 million new cases of breast cancer were reported globally, making it the second most common cancer worldwide. This resulted in nearly 670,000 deaths, and among women, breast cancer is the leading cause of cancer-related mortality, ranking fourth in overall cancer deaths.[1] Currently, chemotherapy is a primary treatment for breast cancer and significantly extends patient survival. However, many patients undergoing chemotherapy often report diverse needs, including information about treatment and rehabilitation, emotional support, the pursuit of hope, and self-fulfillment.[2] Recently, self-advocacy, which is defined as the process of seeking support and achieving personal goals, has garnered increasing attention.

In cancer patients, self-advocacy involves effectively communicating with health care providers, seeking appropriate support, actively participating in medical decision-making, and prioritizing their own needs and desires throughout the process.[3] Individuals with high levels of self-advocacy are able to proactively obtain external support and select medical and care options that meet their needs, thereby improving their prognosis and enhancing their quality of life.[4] Effective self-advocacy can improve patients' prognosis and quality of life while also decreasing health care utilization.[5] However, research indicates that breast cancer patients frequently lack awareness of self-advocacy, demonstrate inadequate initiative, face numerous challenges in the advocacy process,[6] and show moderate to low levels of self-advocacy.[7]

However, there is currently no standardized criterion for assessing the levels of self-advocacy among patients with breast cancer. The heterogeneity among different patient groups is frequently overlooked, resulting in sub-optimal efficiency and accuracy in current self-advocacy interventions. Therefore, we believe that it is essential to identify

* Corresponding author.
E-mail address: tengliping@jiangnan.edu.cn (L. Teng).
# These authors contributed equally to this work.

https://doi.org/10.1016/j.apjon.2024.100648
Received 1 October 2024; Accepted 19 December 2024

subgroups of self-advocacy. Latent Profile Analysis (LPA) categorizes patients into homogeneous groups based on continuous data to maximize differentiation using model-fitting metrics.[8] This study employed LPA to investigate the internal features of self-advocacy among patients with breast cancer, aiming to identify key intervention opportunities throughout self-advocacy progression. These findings would offer insights into improving the self-advocacy of bpatients with breast cancer.

Previous research has identified multiple factors influencing self-advocacy among cancer patients, encompassing demographic factors, personal characteristics, social support,[9] and disease-related factors.[10] Notably, Studies have shown that the severity of symptoms is the primary factor affecting patients' active participation in medical decision-making, active communication, and learning to master new skills.[11] Severe symptom distress can affect cancer patients' determination to treatment adherence and their ability to make informed decisions about their treatment, ultimately hindering their involvement in treatment decision-making. Moreover, significant symptom distress leads to reduced social activity, resulting in social withdrawal and hindering effective communication with health care providers,[12] thereby affecting patients' self-advocacy. In addition, studies have shown that patients are plagued by many uncomfortable symptoms for a long time, which can reduce patients' confidence in the control of symptoms and the common management of disease, resulting in questioning and ultimately impeding their active involvement in treatment decisions and hindering effective communication with health care professionals.[13] Previous research has identified symptom severity as a factor influencing self-advocacy. Structural equation modeling analysis has shown that symptom burden composed of symptom severity and symptom interference was a critical element for cancer patients' self-advocacy.[10] The Capability, Opportunity, and Motivation to Behavior (COM-B) model proposes that an individual's capability (e.g., psychological or physical ability) can directly influence their behavior.[14] A previous study that applied the COM-B model found that postoperative discomfort symptoms in older adults, which represented a form of physical capability, impacted their pulmonary rehabilitation behaviors.[15] Additionally, another study using the COM-B model indicated that symptoms of musculoskeletal disorders were perceived as a form of physical capability, influencing patients' levels of physical activity.[16] Building on the COM-B model and previous research regarding the relationship between symptoms and self-advocacy, this study proposed that symptom severity as a disease-related factor could be seen as an indication of physical function, which is an aspect of physical capability, while self-advocacy, viewed as a behavior, might be influenced by the severity of these symptoms. Therefore, effectively managing symptoms in cancer patients might be crucial for enhancing their levels of self-advocacy.

However, patients with breast cancer often contend with several simultaneous symptoms that interact, which potentially complicates their condition further.[17] Previous research has mainly focused on interventions targeting single symptoms to alleviate them and promote patients' problem-solving and self-decision-making.[18] Focusing on a single symptom overlooks the intrinsic relationships between symptoms, hindering the improvement of overall self-advocacy levels and the achievement of lasting and profound health improvements. This could be the reason why the current self-advocacy management measures strategies are not very effective. Network analysis visually represents the internal system structure through a network, emphasizing critical nodes and structural attributes in breast cancer symptom networks. Network analysis reveals the interrelationships among symptoms, facilitating the identification of potential essential factors and the exploration of core symptoms. By managing these core symptoms, the incidence of other related symptoms may decrease, thereby enhancing integrated self-advocacy.

Therefore, integrating LPA with network analysis holds promise for developing more precise and personalized interventions.[19] This study aimed to (1) identify subgroups of self-advocacy in patients with breast cancer using LPA, (2) examine the potential heterogeneity in demographic and clinical characteristics, particularly the severity of symptoms among the identified subgroups, and (3) determine the core symptom within the symptom networks of each subgroup to establish intervention targets for improving self-advocacy in patients with breast cancer.

Methods

Participants and setting

This cross-sectional study was conducted from September 2023 to March 2024 at the Affiliated Hospital of Jiangnan University in Wuxi, China. The inclusion criteria for participants were as follows: (1) aged 18 years or older; (2) diagnosed with breast cancer and receiving chemotherapy; (3) had received at least one cycle of chemotherapy during this chemotherapy treatment; and (4) were aware of their condition and participated voluntarily. The exclusion criteria included (1) cognitive impairment or mental illness and (2) inability to communicate due to severe physical illnesses.

Sample size

To ensure reliable and precise subgroup results in LPA, a minimum of 300 participants is necessary.[20] For network analysis, a sample size should be 5–6 times the number of variables.[21,22] With 13 variables included in the current network, this suggested a minimum requirement of 65 participants per subgroup.

Instruments

Demographic and clinical characteristics

Sociodemographic variables included age, residence, education status, annual household income, and marital status. The clinical information included time since diagnosis, cancer stage, surgery type, intrinsic subtype, chemotherapy cycle, and symptom severity.

Self-advocacy

The Female Self Advocacy in Cancer Survivorship (FSACS) scale was used to evaluate how female cancer survivors advocate for their needs and priorities when confronted with challenges.[23] The Chinese version of the FSACS, validated and translated by Feng et al., was applied in this research.[24] This 6-point Likert-type scale includes 18 items that assess three domains, including informed decision-making (6 items), effective communication (6 items), and connected strength (6 items). The range of scores is from 18 to 108, with higher values representing greater levels of self-advocacy. The total FSACS scale had a Cronbach's α of 0.819, while the subscales had values ranging from 0.647 to 0.759.[24]

Self-reported symptoms

The M. D. Anderson Symptom Inventory (MDASI) is a validated tool used to measure 13 different symptoms reported by patients over the last 24 hours. Symptoms assessed include pain, fatigue, nausea, disturbed sleep, distress/upset, shortness of breath, difficulty remembering, lack of appetite, drowsiness, dry mouth, sadness, vomiting, and numbness/tingling.[25] The Chinese version of the MDASI (MDASI-C), validated and translated by Wang et al., was applied in this research.[26] Each symptom ranges from "not present" (0) to "as bad as you can imagine" (10). The final score was obtained by summing up the scores of each symptom, generating a minimum value of 0 and a maximum of 130. Higher scores indicated greater symptom severity. The Cronbach's α for MDASI-C was 0.82–0.94.[27]

Data collection

Posters and flyers were distributed to patients in the wards to attract participants interested in this study. Before the survey began, patients

were given a comprehensive explanation of this study's objectives and procedures. It was emphasized that participation was voluntary, and that they could withdraw at any time without incurring any penalties. Those who agreed to participate were required to provide formal written informed consent. Data collection was conducted through in-person, individual interviews by well-trained investigators from the research team, who possess extensive knowledge of breast cancer nursing and good research skills. Patients completed the entire survey independently. For those who were unable to complete the survey on their own, researchers read each question along with the corresponding options, allowing the patients to respond based on their individual circumstances, while researchers assisted in recording these responses. Any incomplete items were confirmed with the patient on the spot to ensure the completeness of the data.

Data analysis

Statistical analyses were performed using SPSS version 25.0, Mplus version 8.0, and R version 4.3.1. For categorical variables, frequencies and percentages were calculated to perform descriptive analysis. The mean and standard deviation were employed to outline continuous variables that exhibited a normal distribution.

LPA was conducted using Mplus 8.0 to classify subgroups of self-advocacy in individuals with breast cancer.[28] To determine the optimal number of subgroups, comparisons were made using the Akaike information criterion (AIC), Bayesian information criterion (BIC), sample-size-adjusted BIC (ABIC), bootstrapped likelihood ratio test (BLRT), Lo-Mendell-Rubin likelihood ratio test (LMR), and entropy of each model. Lower values of AIC, BIC, and ABIC indicate an optimal model fitness.[29] A significance level below 0.05 in LMR and BLRT suggests rejection of the k-1 model and acceptance of the k model.[30] Also, entropy serves as a summary statistic for classification, with values ranging from 0 to 1.0, where values closer to 1.0 indicate better classification.[31]

After identifying the subgroups, we examined their differences using one-way analysis of variance (ANOVA), Pearson's chi-square tests, and Fisher's exact tests. The Bonferroni method was used to perform post hoc contrasts for between-group analyses. Subsequently, significant factors were incorporated into the multinomial logistic regression analysis.

The network analysis was conducted using R version 4.3.1 with the qgraph package. The relationships (edges) between symptom pairs (nodes) in the subgroups were evaluated using Spearman's correlations. The Fruchterman-Reingold (FR) algorithm and a spring layout were employed to construct the symptom network. Using the FR algorithm, the symptom with the highest centrality was located at the center of the network, while nodes sharing similar features were positioned closer to one another. In the network analysis, strength, betweenness, and closeness centrality indices were employed to determine the most core symptoms. Strength reflects network connectivity, with higher values signifying a greater tendency for the symptom to co-occur with others.[32] Among the three indices, strength is regarded as the most critical in current network research.[33] Betweenness measures how often a node is found on the shortest path between two other nodes. The higher a node's betweenness centrality, the more it influences the network.[34] Closeness indicates the average proximity of a symptom to all other nodes, using inverse distance as the metric. An increased closeness value corresponds to a shorter path.[34] We conducted bootstrapping using the bootnet R package to assess the accuracy and stability of the network. 95% bootstrap confidence intervals (CIs) for the edge weights, derived from nonparametric bootstrapping (nBoots = 1000), were employed to evaluate the accuracy of the estimated network connections. We used the correlation stability (CS) coefficient to measure how stable the centrality indices were. The recommended minimum for the CS coefficient is 0.25, with values greater than 0.5 being preferable.[35] A *P* value below 0.05 indicated statistical significance.

Ethical considerations

This study was approved by the Ethical Committee of Jiangnan University (IRB No. JNU20230901IRB01) and was conducted in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All participants provided written informed consent.

Results

Sample characteristics

In this study, 320 participants were enrolled, and their characteristics are detailed in Table 1. Overall, the ages of participants varied between 30 and 79, with a mean age of 53.44 (SD = 10.31). The majority of participants lived in urban (72.5%), had a middle school education level (54.4%), had a family annual income under ¥130,000 (68.1%), and were married (97.2%). Among all participants, 75.0% were diagnosed with the disease within the past year, 40.6% were at stage II of cancer, 38.1% received a modified radical mastectomy, 62.5% were diagnosed with Luminal B (HER2 positive) subtype, and 24.1% were in the second cycle of treatment. The severity of symptoms experienced by participants was 47.68 (SD = 16.20).

Self-advocacy subgroups identified by LPA

LPA classified participants into three subgroups, determined by their self-advocacy scores. Detailed fit indices of the latent profile model are outlined in Table 2. With increasing model profiles, the AIC, BIC, and ABIC values steadily declined. However, the LMR test did not reveal a significant difference between the four-profile and five-profile latent profile models ($P > 0.05$). The BLRT and LMR tests identified the three-profile model as the optimal one, showing significant differences ($P < 0.05$). Additionally, the three-profile model was selected for its higher entropy value and clinical significance.

Fig. 1 illustrates the distribution of self-advocacy scores across items in the three-profile model. All items had lower scores for the bottom line, which was therefore categorized as “low self-advocacy” ($n = 110$, 34.4%). Characterized by medium scores across all items, the middle line was classified as “moderate self-advocacy” ($n = 137$, 42.8%). The top line displayed high scores across all items, identifying it as “high self-advocacy” ($n = 73$, 22.8%).

Differences in self-advocacy among distinct subgroups

Table 3 presents the statistically significant differences in the self-advocacy total scale score and three dimensions among distinct subgroups in this study (both $P < 0.001$). A post hoc analysis found that patients in the high self-advocacy group scored higher than those in the moderate and low self-advocacy groups on the total scale score and each dimension. Similarly, the moderate self-advocacy group had higher scores than the low self-advocacy group.

Heterogeneity in demographic and clinical characteristics among distinct subgroups

There were statistically significant differences in symptom severity, surgery type, and cancer stage between the three subgroups ($P < 0.05$) (Table 1). The results of the multinomial logistic regression analysis for the three profiles are detailed in Table 4, with Profile 3 selected as the reference category. Compared to Profile 3, the patients in Profile 1 were more likely to have higher symptom severity (OR = 1.074; 95% CI, 1.048–1.101; $P < 0.001$) and to be in stage IV (OR = 3.947; 95% CI, 1.152–13.520; $P = 0.029$), and less likely to receive breast reconstruction (OR = 0.221; 95% CI, 0.055–0.885; $P = 0.033$). Similarly, compared with Profile 3, the patients in Profile 2 were more likely to have higher

Table 1
Differences in demographic and clinical characteristics among subgroups ($N = 320$).

Variables	Total ($n = 320$) Mean ± SD / n (%)	Profile 1 ($n = 110$) Mean ± SD / n (%)	Profile 2 ($n = 137$) Mean ± SD / n (%)	Profile 3 ($n = 73$) Mean ± SD / n (%)	Statistics
Age, years	53.44 ± 10.31	51.82 ± 11.08	53.99 ± 9.79	54.85 ± 9.87	$F = 2.258$ $P = 0.106$
Residence					$\chi^2 = 0.439$
Rural	88 (27.5)	32 (29.1)	38 (27.7)	18 (24.7)	$P = 0.803$
Urban	232 (72.5)	78 (70.9)	99 (72.3)	55 (75.3)	
Education status					$\chi^2 = 3.460$
Primary school or below	41 (12.8)	14 (12.7)	19 (13.9)	8 (11.0)	$P = 0.749$
Middle school	174 (54.4)	63 (57.3)	73 (53.3)	38 (52.1)	
High school	71 (22.2)	19 (17.3)	32 (23.4)	20 (27.4)	
College/University or above	34 (10.6)	14 (12.7)	13 (9.5)	7 (9.6)	
Annual household income					$\chi^2 = 4.797$
< ¥130,000	218 (68.1)	79 (71.8)	92 (67.2)	47 (64.4)	$P = 0.282$
¥130,000-¥300,000	97 (30.3)	31 (28.2)	43 (31.4)	23 (31.5)	
> ¥300,000	5 (1.6)	0 (0.0)	2 (1.5)	3 (4.1)	
Marital status					$\chi^2 = 6.236$
Single	5 (1.6)	4 (3.6)	0 (0.0)	1 (1.4)	$P = 0.100$
Married	311 (97.2)	105 (95.5)	134 (97.8)	72 (98.6)	
Divorced/ Widowed	4 (1.3)	1 (0.9)	3 (2.2)	0 (0.0)	
Time since diagnosis, years					$\chi^2 = 4.732$
< 1	240 (75.0)	79 (71.8)	104 (75.9)	57 (78.1)	$P = 0.316$
1-3	53 (16.6)	22 (20.0)	18 (13.1)	13 (17.8)	
> 3	27 (8.4)	9 (8.2)	15 (10.9)	3 (4.1)	
Cancer stage					$\chi^2 = 14.294$
Stage I	40 (12.5)	9 (8.2)	16 (11.7)	15 (20.5)	**$P = 0.027$**
Stage II	130 (40.6)	43 (39.1)	56 (40.9)	31 (42.5)	
Stage III	64 (20.0)	18 (16.4)	30 (21.9)	16 (21.9)	
Stage IV	86 (26.9)	40 (36.4)	35 (25.5)	11 (15.1)	
Surgery type					$\chi^2 = 29.216$
Breast conservation	58 (18.1)	12 (10.9)	31 (22.6)	15 (20.5)	**$P < 0.001$**
Modified radical mastectomy	122 (38.1)	44 (40.0)	57 (41.6)	21 (28.8)	
Total mastectomy	111 (34.7)	49 (44.5)	41 (29.9)	21 (28.8)	
Breast reconstruction	29 (9.1)	5 (4.5)	8 (5.8)	16 (21.9)	
Intrinsic subtype					$\chi^2 = 10.654$
Luminal A	16 (5.0)	6 (5.5)	8 (5.8)	2 (2.7)	$P = 0.212$
Luminal B (HER2 negative)	18 (5.6)	8 (7.3)	3 (2.2)	7 (9.6)	
Luminal B (HER2 positive)	200 (62.5)	64 (58.2)	89 (65.0)	47 (64.4)	
Erb-B2 overexpression	67 (20.9)	23 (20.9)	32 (23.4)	12 (16.4)	
Basal-like	19 (5.9)	9 (8.2)	5 (3.6)	5 (6.8)	
Chemotherapy cycle					$\chi^2 = 14.006$
First cycle	15 (4.7)	3 (2.7)	5 (3.6)	7 (9.6)	$P = 0.449$
Second cycle	77 (24.1)	29 (26.4)	32 (23.4)	16 (21.9)	
Third cycle	62 (19.4)	28 (25.5)	23 (16.8)	11 (15.1)	
Fourth cycle	73 (22.8)	23 (20.9)	34 (24.8)	16 (21.9)	
Fifth cycle	36 (11.3)	9 (8.2)	20 (14.6)	7 (9.6)	
Sixth cycle	28 (8.8)	8 (7.3)	11 (8.0)	9 (12.3)	
Seventh cycle	18 (5.6)	5 (4.5)	8 (5.8)	5 (6.8)	
Eighth cycle	11 (3.4)	5 (4.5)	4 (2.9)	2 (2.7)	
Symptom severity	47.68 ± 16.20	54.30 ± 16.11	47.52 ± 14.20	38.03 ± 15.08	$F = 25.571$ **$P < 0.001$**

SD, Standard deviation.
Data in bold indicates statistical significance.

symptom severity (OR = 1.047; 95% CI, 1.024–1.078; $P < 0.001$), and less likely to receive breast reconstruction (OR = 0.163; 95% CI, 0.052–0.506; $P = 0.002$).

Symptom networks of distinct subgroups

The symptom network diagrams and centrality indices, including strength, closeness, and betweenness, for the three subgroups are depicted in Fig. 2. Among the three subgroups, the strongest edge was between "drowsiness" and "disturbed sleep". The core symptom observed in the network of Profile 1 (Fig. 2A) was "lack of appetite" ($r_{strength} = 2.080$, $r_{closeness} = 1.450$, $r_{betweenness} = 2.076$). In the network of Profile 2 (Fig. 2B), "distress" was the most central symptom ($r_{strength} = 1.426$, $r_{closeness} = 1.874$, $r_{betweenness} = 1.600$). The centrality indices consistently identified "distress" as the core symptom in the network of Profile 3 (Fig. 2C) ($r_{strength} = 1.798$, $r_{closeness} = 1.076$, $r_{betweenness} = 0.697$).

The stability and accuracy analysis produced highly favorable results. The bootstrapping of the edge weights showed slight variation, indicated by the small grey area in Supplementary Fig. S1, highlighting the excellent stability of the edge weights within the network. Moreover, the CS-coefficients indicated strong reliability for network accuracy metrics like betweenness, closeness, and strength, as illustrated in Supplementary Fig. S2.

Discussion

Main findings

In this study, LPA was applied for the first time to delineate three distinct profiles of self-advocacy among patients with breast cancer and to find differences in their symptom severity, surgery type, and cancer stage between the three subgroups. Additionally, the symptom networks within these subgroups elucidated the core symptoms, which might inform the development of targeted interventions tailored to the unique

Table 2
Latent profile model fit indices ($N = 320$).

Model	AIC	BIC	aBIC	Entropy	BLRT	LMR	Class probability
1	16,956.091	17,092.569	16,978.383				1
2	15,369.084	15,576.342	15,401.892	0.908	< 0.001	< 0.001	0.53750/0.46250
3	**14,858.789**	**15,137.653**	**14,902.938**	**0.920**	**< 0.001**	**0.0232**	**0.34375/0.42812/0.22812**
4	14,753.368	15,103.822	14,808.842	0.914	< 0.001	0.0925	0.33437/0.08750/0.36250/0.21563
5	14,643.817	15,065.869	14,710.625	0.874	< 0.001	0.2697	0.11875/0.31250/0.19062/0.19062/0.18750

AIC, Akaike information criterion; BIC, Bayesian information criterion; aBIC, adjusted Bayesian information criterion; BLRT, bootstrapped likelihood ratio test; LMR, Lo-Mendell-Rubin likelihood ratio test.
Data in bold indicates statistical significance.

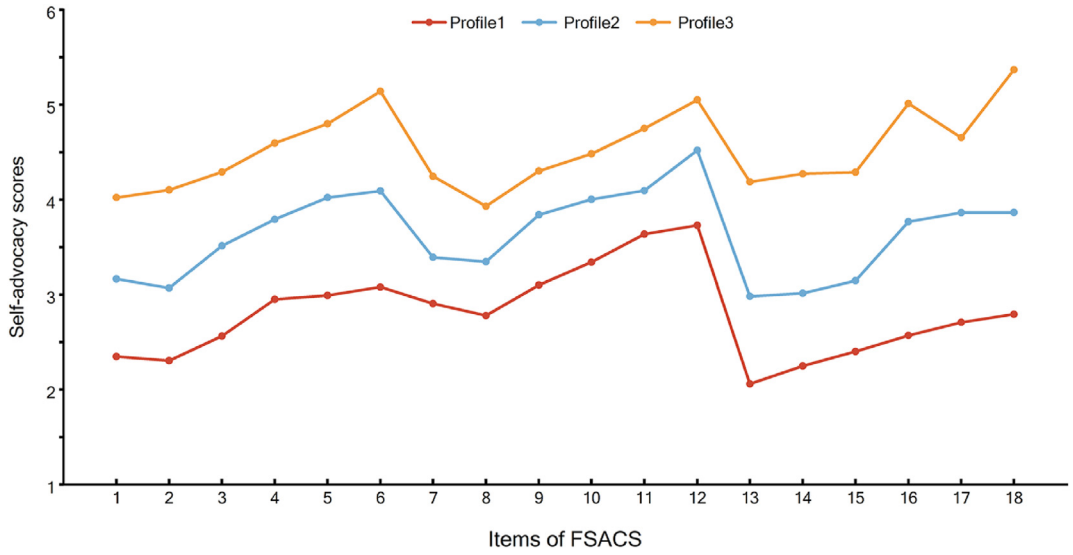

Fig. 1. Latent profile analysis of self-advocacy in breast cancer. Profile 1: low self-advocacy, Profile 2: moderate self-advocacy, Profile 3: high self-advocacy. FSACS, Female Self Advocacy in Cancer Survivorship.

Table 3
Descriptive statistics for three distinct subgroups ($N = 320$).

Characteristic	Profile 1 (1) ($n = 110$) Mean ± SD	Profile 2 (2) ($n = 137$) Mean ± SD	Profile 3 (3) ($n = 73$) Mean ± SD	F (P)	Post hoc
FSACS	50.42 ± 5.49	65.47 ± 4.17	81.56 ± 5.25	$F = 282.038$ **$P < 0.001$**	1 < 2 < 3
Informed decision-making	16.18 ± 2.61	21.66 ± 3.01	26.99 ± 3.51	$F = 174.006$ **$P < 0.001$**	1 < 2 < 3
Effective communication	19.48 ± 2.52	23.18 ± 1.71	26.81 ± 2.78	$F = 591.900$ **$P < 0.001$**	1 < 2 < 3
Connected strength	14.75 ± 2.61	20.64 ± 3.15	27.77 ± 2.43	$F = 747.404$ **$P < 0.001$**	1 < 2 < 3

FSACS, Female Self Advocacy in Cancer Survivorship; SD, standard deviation.
Data in bold indicates statistical significance.

characteristics of each subgroup.

In this study, we identified significant differences in the total score and three dimensions of self-advocacy among three distinct subgroups: low self-advocacy (Profile 1), moderate self-advocacy (Profile 2), and high self-advocacy (Profile 3). This finding indicated that individualized nursing care might be beneficial for patients with breast cancer due to the varied experiences with self-advocacy. Previous studies have shown that multimedia,[36] group counseling,[37] and knowledge training[38] could effectively improve patients' self-advocacy. Based on these findings, tailored interventions could be developed to address the specific needs of patients with breast cancer in different self-advocacy profiles, to improve their quality of life and outcomes.

The three subgroups were found to have significant differences in symptom severity, surgery type, and cancer stage. Compared to patients with high self-advocacy, those with low and moderate self-advocacy were more likely to have higher symptom severity. The finding aligned with the previous study,[39] indicating that greater symptom severity is linked to lower levels of self-advocacy. The severity of a patient's clinical symptoms can affect their physical abilities. As these symptoms worsen, the patient's ability to engage in self-advocacy behaviors may be impaired. They are more likely to experience physical limitations (e.g., mobility issues, pain restrictions), which can reduce their agency and initiative.[40] As a result, this may hinder the patient's active participation in treatment discussions, limiting their engagement in self-advocacy behaviors.[41] Patients suffering from severe illnesses may encounter more complex health challenges, including worsening physical and emotional symptoms and changes in treatment. These difficulties may result in a perceived loss of control over their health, lower their self-confidence, and negatively impair their self-advocacy.[39,42] For instance, cancer patients frequently experience symptoms that diminish

Table 4
Multinomial logistic regression analysis of subgroups ($N = 320$).

Characteristic	Profile 1 VS Profile 3 (Ref)			Profile 2 VS Profile 3 (Ref)		
	OR	95% CI	*P*	OR	95% CI	*P*
Symptom severity	**1.074**	**1.048, 1.101**	**< 0.001**	**1.047**	**1.024, 1.078**	**< 0.001**
Surgery type						
Breast conservation	ref			ref		
Total mastectomy	2.356	0.874, 6.351	0.090	0.849	0.360, 2.000	0.708
Modified radical mastectomy	1.899	0.680, 5.303	0.221	1.067	0.445, 2.558	0.884
Breast reconstruction	**0.221**	**0.055, 0.885**	**0.033**	**0.163**	**0.052, 0.506**	**0.002**
Cancer stage						
Stage I	ref			ref		
Stage II	2.472	0.864, 7.074	0.092	2.004	0.813, 4.943	0.131
Stage III	1.826	0.548, 6.088	0.327	1.930	0.685, 5.438	0.214
Stage IV	**3.947**	**1.152, 13.520**	**0.029**	2.824	0.937, 8.507	0.065

OR, odds ratio; CI, confidence interval.
Data in bold indicates statistical significance.

their motivation for social activities,[43] limit their participation in society,[44] and subsequently restrict communication with health care professionals. This might make it difficult for patients to express their needs and reduce active participation in medical decision-making. Additionally, cancer-related symptoms significantly reduce patients' physical strength and energy levels,[45] leading to difficulties in concentration and clear thinking.[46] Consequently, many patients find it challenging to engage in discussions about their care or articulate their needs effectively.[47] Collectively, these challenges faced by patients might hinder their self-advocacy. Therefore, it might be crucial for health care professionals to assist patients in effectively managing their symptoms to enhance their self-advocacy.

Notably, this study found that the type of surgery influenced the subgroup to which patients belonged. Compared to Profile 3, patients in Profile 1 and Profile 2 were less likely to receive breast reconstruction. Although the mechanism of this relationship is unclear, it is speculated that breast reconstruction surgery could significantly enhance postoperative breast appearance,[48] reduce psychological trauma from mastectomy,[49] and does not affect tumor recurrence.[50] It alleviates anxiety and depression in patients, helping them regain confidence and actively participate in autonomous decision-making, thereby enhancing their self-advocacy.[39] Research has indicated that patients with breast cancer undergoing breast reconstruction surgery often exhibited lower cortisol levels.[51] Fluctuations in cortisol levels were strongly linked to prefrontal cortex function, which was crucial for decision-making, personality expression, and the regulation of complex behaviors.[52] Thus, lower cortisol levels in these patients might indicate stable prefrontal cortex function. This stability could help patients with breast cancer undergoing reconstruction surgery make informed decisions, express their needs clearly, and engage in effective communication with health care providers. Therefore, health care providers should offer comprehensive psychological counseling and informative support to patients undergoing breast reconstruction. This support might help them adapt to physical changes. Additionally, patients might be encouraged to ask questions and participate in decision-making, gradually strengthening their self-advocacy awareness and improving their overall quality of life.

Additionally, this study identified that patients with low self-advocacy had a higher likelihood of being diagnosed at stage IV compared to those with high self-advocacy. This finding accorded with previous research, indicating that the lower the cancer stage in gynecological cancer patients, the higher their level of self-advocacy.[53] Patients diagnosed at an early stage, where cancer cells have not yet spread, usually experience fewer symptoms and enjoy a higher survival rate. Their overall quality of life is generally better than that of late-stage patients, and their emotions tend to be more stable, allowing them to focus more on treatment-related concerns.[10] In contrast, patients with advanced cancer often have limited treatment options, a poor prognosis, and a shorter expected survival time, all of which can significantly affect their mental health. This situation may lead to a gradual loss of their sense of self-worth, meaning, and dignity. As a result, these patients might communicate less with health care providers and become less involved in medical decision-making.[54] Thus, health care professionals might need to evaluate self-advocacy levels among cancer patients at different tumor stages, giving particular attention to those with advanced-stage cancer and poor prognoses. These patients might be able to receive enhanced informational, communicative, and psychological support to improve their self-advocacy.

To enhance the management of risk factors within the low self-advocacy subgroup, implementing effective symptom management strategies tailored to this subgroup might prove to be a promising approach. In this study, the core symptom associated with each subgroup was identified through network analysis, thereby providing a specific target for symptom management. Network analysis identified “lack of appetite” as the core symptom of Profile 1. Xun et al.[55] have also found that “lack of appetite” was a core symptom within the symptom network of cancer patients. A decline in appetite makes it harder for patients to consume sufficient nutrients, greatly increasing the risk of malnutrition.[56] Malnutrition is frequently linked to emotional apathy, depression, anxiety, and self-neglect.[57] These combined factors further reduce patients' motivation, hindering them from expressing their needs, communicating effectively, and participating in medical decision-making. Another possible mechanism is that cancer patients often exhibit elevated levels of inflammatory markers, such as interleukin-1β (IL-1β), IL-6, and tumor necrosis factor-α (TNF-α), during episodes of appetite loss.[58,59] Research indicated that increased levels of these pro-inflammatory cytokines were linked to cognitive decline. Specifically, elevated inflammatory markers may result in cognitive decline, including memory loss, slower processing speed, diminished decision-making abilities, attention deficits, and executive dysfunction.[60,61] These cognitive declines might, in turn, limit the patient's engagement in treatment decisions and hinder effective communication with health care providers. In summary, patients with a lack of appetite were more likely to demonstrate low levels of self-advocacy. Therefore, implementing nutritional interventions, such as dietary counseling to alleviate a lack of appetite, might be crucial for improving self-advocacy levels in individuals with low self-advocacy.

In the symptom networks of Profile 2 and Profile 3, “distress” was identified as a core symptom. This finding aligned with a previous study, which also found “distress” to be the most central symptom in the three networks.[62] patients with breast cancer often experience varying degrees of distress, which can activate the brain's neuroplasticity mechanisms, leading to a series of adaptive changes.[63] This means that patients may become more sensitive when faced with new or complex information, become more attuned to their health, engage more actively in medical decision-making, express personal needs and concerns, and seek relevant support.[64] Although moderate distress may encourage patients to engage more actively in medical decision-making, excessive or prolonged distress can negatively affect their physical health and hinder their involvement in medical decision-making. Therefore, it might be essential to adopt a balanced and comprehensive approach to managing their

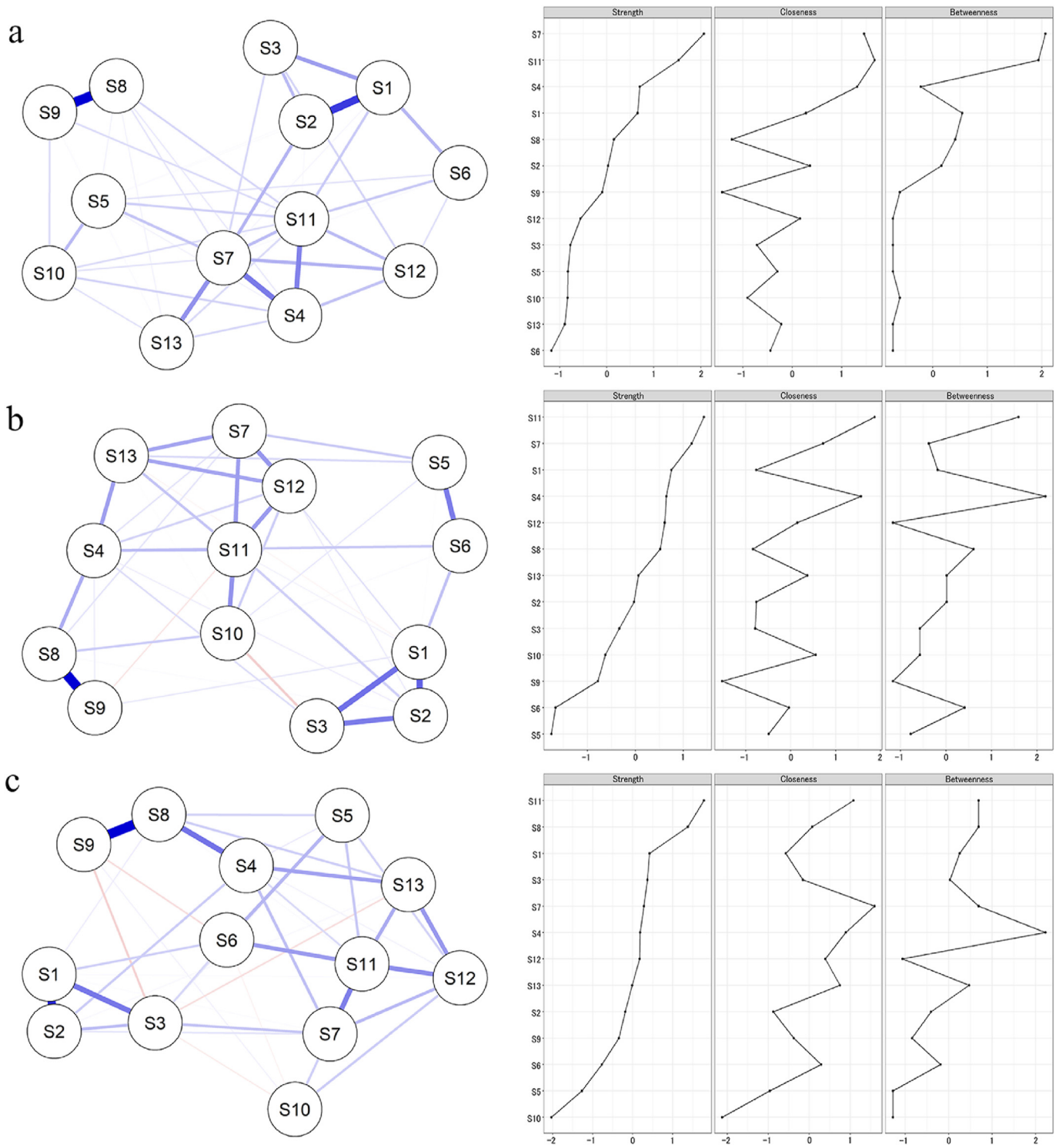

Fig. 2. Symptom networks (left panel) and the corresponding centrality indices (right panel) for the three subgroups. (a): Profile 1, (b): Profile 2, (c): Profile 3. (S1) Pain, (S2) Fatigue, (S3) Numbness, (S4) Sadness, (S5) Shortness of breath, (S6) Difficulty remembering, (S7) Lack of appetite, (S8) Disturbed sleep, (S9) Drowsiness, (S10) Dry mouth, (S11) Distress, (S12) Vomiting, (S13) Nausea.

distress and ensuring the maintenance of active self-advocacy. This might highlight the importance of early identification and mental interventions to address emotional distress in these individuals. The psychological intervention, the mindfulness and skills-based eHealth intervention, and the acceptance and commitment therapy, have proven effective in reducing the effects of distress.[65–67] These interventions might help patients manage their distress more effectively, maintain active self-advocacy, and enhance their overall quality of life.

Implications for nursing practice and research

Utilizing LPA, this study distinguished distinct subgroups based on self-advocacy levels in patients with breast cancer, thereby enhancing our understanding of self-advocacy. This might support health care staff in paying special attention to high-risk individuals with low self-advocacy, as they are more likely to experience severe symptoms and reach stage IV of breast cancer, and they are also less likely to receive breast reconstruction,

ultimately improving early identification and targeted interventions. Moreover, the network analysis revealed that "lack of appetite" emerged as a core symptom for patients with low self-advocacy, which might provide an indicator for tailoring symptom interventions aimed at the low self-advocacy subgroup among patients with breast cancer.

Limitations

There were several limitations in this study. Firstly, the cross-sectional design restricted us from identifying potential causal connections between variables, and the three latent profiles and symptom networks might have experienced temporal changes. Secondly, the data collected from participants were self-reported, which might lead to self-report and self-selection bias. Thirdly, our analysis only focused on 13 symptoms, overlooking many others. Subsequent research should aim to investigate a more extensive variety of symptoms. Finally, given that LPA focuses on patient-specific characteristics, the outcomes of the three profiles only apply to populations with similar traits.

Conclusions

In conclusion, we have identified three subgroups of self-advocacy among patients with breast cancer in China. This might highlight the necessity for tailored interventions targeting different subgroups, as their self-advocacy varied among individuals based on symptom severity, types of surgery, and stages of cancer. The severity of clinical symptoms might act as a significant risk factor for individuals with low levels of self-advocacy. Additionally, identifying core symptoms such as "lack of appetite" and "distress" within symptom networks of distinct self-advocacy subgroups might pave the way for the development of symptom interventions aimed at improving self-advocacy in patients with breast cancer. Clinical health care providers might consider implementing nutritional support for patients exhibiting low self-advocacy, while offering customized psychological interventions for those with moderate to high self-advocacy, thereby more effectively alleviating their symptom severity and enhancing their self-advocacy levels.

CRediT authorship contribution statement

Liping Teng: Conceptualization, Methodology, Supervision, and Writing – Review & Editing. Yajun Dong: Conceptualization, Methodology, Investigation, Formal Analysis, and Writing – Original Draft. Yiting Yang, Zhou Zhou, and Jun Sun: Investigation, and Formal Analysis. Teng Wang: Methodology, and Supervision. All authors had full access to all the data in the study, and the corresponding author had final responsibility for the decision to submit for publication. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

Ethics statement

This study was approved by the Ethics Committee of Jiangnan University (IRB No. JNU20230901IRB01). All participants provided written informed consent.

Funding

This study was supported by the Top Talent Support Program for young and middle-aged people of the Wuxi Health Committee (Grant No. BJ 2020041). The funders had no role in considering the study design or in the collection, analysis, interpretation of data, writing of the report, or decision to submit the article for publication.

Declaration of competing interest

The authors declare no conflicts of interest.

Data availability statement

The data that support the findings of this study are available from the corresponding author, Liping Teng, upon reasonable request.

Declaration of generative AI and AI-assisted technologies in the writing process

No AI tools/services were used during the preparation of this work.

Acknowledgments

Thanks to all participants for their contribution to this study.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.apjon.2024.100648.

References

1. Bray F, Laversanne M, Sung H, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA A Cancer J Clin*. 2024;74:229–263. https://doi.org/10.3322/caac.21834.
2. He L, Hu L, Chu Y, et al. Qualitive research on the experience needs of symptom management in breast cancer chemotherapy patients during the intermittent period. *Journal of Nurses Training*. 2023;38:475–479. https://doi.org/10.16821/j.cnki.hsjx.2023.05.018.
3. Hagan TL, Donovan HS. Self-advocacy and cancer: a concept analysis. *J Adv Nurs*. 2013;69:2348–2359. https://doi.org/10.1111/jan.12084.
4. Thomas TH, Donovan Hsr MQ, Bender C,M, et al. A conceptual framework of self-advocacy in women with cancer. *ANS Adv Nurs Sci*. 2021;44:E1–E13. https://doi.org/10.1097/ANS.0000000000000342.
5. Zhang Y, Hua X, Zheng F. Research progress of patients' self-advocacy. *Chinese Evidence-Based Nursing*. 2022;8:1900–1903. https://doi.org/10.12102/j.issn.2095-8668.2022.14.010.
6. Jiang Z, Long X, Qing M, et al. A qualitative study of self-advocacy experience in patients with breast cancer. *Journal of Nurses Training*. 2024;39:441–445. https://doi.org/10.16821/j.cnki.hsjx.2024.04.019.
7. Yang Y, Zheng Y, Pei H, et al. Construction and implementation of self-advocacy intervention program for patients with breast cancer on chemotherapy. *Journal of Nursing Science*. 2024;39:6–9+19. https://doi.org/10.3870/j.issn.1001-4152.2024.08.006.
8. He C, Wu C, He Y, et al. Characteristics and influencing factors of social isolation in patients with breast cancer: a latent profile analysis. *Support Care Cancer*. 2023;31:363. https://doi.org/10.1007/s00520-023-07798-0.
9. He L, Wu L, Wang Q. Research progress on self-advocacy of female cancer survivors. *Journal of Nurses Training*. 2022;37:1673–1676. https://doi.org/10.16821/j.cnki.hsjx.2022.18.009.
10. Han R. *Factors Influencing the Level of Self-Advocacy in Gynecological Cancer Patients and its Path Analysis*. North China University of Science and Technology; 2023. https://link.cnki.net/doi/10.27108/d.cnki.ghelu.2023.000811.
11. Huang H, Luo Y. Analysis of self-management status and influencing factors in elderly patients with chronic obstructive pulmonary disease. *Nursing Practice and Research*. 2017;14:36–38. https://doi.org/10.3969/j.issn.1672-9676.2017.15.013.
12. Wu X, Zheng M, Zhang M, et al. Research progress of symptom distress assessment tools for cancer patients. *Chin J Nurs*. 2016;51:200–205. https://doi.org/10.3761/j.issn.0254-1769.2016.02.013.
13. Geng M, Su S, Li Q, et al. The symptom burden in maintenance hemodialysis patients and its influencing factors. *Guangzhou Medical Journal*. 2021;52:57–63. https://doi.org/10.3969/j.issn.1000-8535.2021.05.012.
14. Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. *Implement Sci*. 2011;6:42. https://doi.org/10.1186/1748-5908-6-42.
15. Zhu H, Pang J, Sun S, et al. A qualitative study of the factors of pulmonary rehabilitation behavior of elderly patients with lung cancer in the post-operative transitional period. *Chin J Nurs*. 2024;59:15–21. https://doi.org/10.3761/j.issn.0254-1769.2024.01.002.
16. Webb J, Baker A, Palmer T, et al. The barriers and facilitators to physical activity in people with a musculoskeletal condition: a rapid review of reviews using the COM-B model to support intervention development. *Public Health Pract (Oxf)*. 2022;3:100250. https://doi.org/10.1016/j.puhip.2022.100250.
17. So WKW, Law BMH, Ng MSN, et al. Symptom clusters experienced by patients with breast cancer at various treatment stages: a systematic review. *Cancer Med*. 2021;10:2531–2565. https://doi.org/10.1002/cam4.3794.
18. Luo X, Chen Y, Chen J, et al. Effectiveness of mobile health-based self-management interventions in patients with breast cancer: a meta-analysis. *Support Care Cancer*. 2022;30:2853–2876. https://doi.org/10.1007/s00520-021-06568-0.
19. Cai T, Zhou T, Huang Q, et al. Cancer-related symptoms among young and middle-aged women undergoing chemotherapy for breast cancer: application of latent class

analysis and network analysis. *Eur J Oncol Nurs*. 2023;63:102287. https://doi.org/10.1016/j.ejon.2023.102287.
20. Williams GA, Kibowski F. Latent class analysis and latent profile analysis. In: Jason LA, Glenwick DS, eds. *Handbook of Methodological Approaches to Community-Based Research: Qualitative, Quantitative, and Mixed Methods*. Oxford: Oxford University Press; 2016:143–153.
21. Fernández-de-Las-Peñas C, Palacios-Ceña M, Valera-Calero JA, et al. Understanding the interaction between clinical, emotional and psychophysical outcomes underlying tension-type headache: a network analysis approach. *J Neurol*. 2022;269:4525–4534. https://doi.org/10.1007/s00415-022-11039-5.
22. Memon MA, Ting H, Cheah JH, et al. Sample size for survey research: review and recommendations. *Journal of applied structural equation modeling*. 2020;4:i–xx. https://doi.org/10.47263/jasem.4(2)01.
23. Hagan TL, Cohen S, Stone C, et al. Theoretical to tangible: creating a measure of self-advocacy for female cancer survivors. *J Nurs Meas*. 2016;24:428–441. https://doi.org/10.1891/1061-3749.24.3.428.
24. Feng L, Tan L, Yu H. Chinese version of Female Self-Advocacy in Cancer Survivorship and its reliability and validity test. *Chin Nurs Res*. 2021;35:377–381. https://doi.org/10.12102/j.issn.1009-6493.2021.03.001.
25. Cleeland CS, Mendoza TR, Wang XS, et al. Assessing symptom distress in cancer patients: the M.D. Anderson Symptom Inventory. *Cancer*. 2000;89:1634–1646. https://doi.org/10.1002/1097-0142(20001001)89:7<1634::aid-cncr29>3.0.co;2-v.
26. Wang XS, Wang Y, Guo H, et al. Chinese version of the M. D. Anderson Symptom Inventory: validation and application of symptom measurement in cancer patients. *Cancer*. 2004;101:1890–1901. https://doi.org/10.1002/cncr.20448.
27. Ye Y, Qin L, Zeng K, et al. Identifying core symptoms and symptom clusters in patients during intermittent period of cancer therapy. *Journal of Nursing Science*. 2022;37:20–24. https://doi.org/10.3870/j.issn.1001-4152.2022.01.020.
28. Bauer GR, Mahendran M, Walwyn C, et al. Latent variable and clustering methods in intersectionality research: systematic review of methods applications. *Soc Psychiatr Psychiatr Epidemiol*. 2022;57:221–237. https://doi.org/10.1007/s00127-021-02195-6.
29. Roesch SC, Villodas M, Villodas F. Latent class/profile analysis in maltreatment research: a commentary on Nooner et al., Pears et al., and looking beyond. *Child Abuse Negl*. 2010;34:155–160. https://doi.org/10.1016/j.chiabu.2010.01.003.
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. *Struct Equ Model: A Multidiscip J*. 2007;14:535–569. https://doi.org/10.1080/10705510701575396.
31. Zhang Y, Xiong Y, Yu Q, et al. The activity of daily living (ADL) subgroups and health impairment among Chinese elderly: a latent profile analysis. *BMC Geriatr*. 2021;21:30. https://doi.org/10.1186/s12877-020-01986-x.
32. Yang Z, Zhu Z, Wen H, et al. Identifying subtypes of HIV/AIDS-related symptoms in China using latent profile analysis and symptom networks. *Sci Rep*. 2022;12:13271. https://doi.org/10.1038/s41598-022-17720-z.
33. Epskamp S, Fried EI. A tutorial on regularized partial correlation networks. *Psychol Methods*. 2018;23:617–634. https://doi.org/10.1037/met0000167.
34. Wen H, Zhu Z, Hu T, et al. Unraveling the central and bridge psychological symptoms of people living with HIV: a network analysis. *Front Public Health*. 2022;10:1024436. https://doi.org/10.3389/fpubh.2022.1024436.
35. Epskamp S, Waldorp LJ, Mõttus R, et al. The Gaussian graphical model in cross-sectional and time-series data. *Multivariate Behav Res*. 2018;53:453–480. https://doi.org/10.1080/00273171.2018.1454823.
36. Hoffman AS, Lowenstein LM, Kamath GR, et al. An entertainment-education colorectal cancer screening decision aid for African American patients: a randomized controlled trial. *Cancer*. 2017;123:1401–1408. https://doi.org/10.1002/cncr.30489.
37. Jonikas JA, Grey DD, Copeland ME, et al. Improving propensity for patient self-advocacy through wellness recovery action planning: results of a randomized controlled trial. *Community Ment Health J*. 2013;49:260–269. https://doi.org/10.1007/s10597-011-9475-9.
38. Hawley L, Morey C, Sevigny M, et al. Enhancing self-advocacy after traumatic brain injury: a randomized controlled trial. *J Head Trauma Rehabil*. 2022;37:114–124. https://doi.org/10.1097/htr.0000000000000689.
39. Thomas TH, Taylor S, Rosenzweig M, et al. Self-advocacy behaviors and needs in women with advanced cancer: assessment and differences by patient characteristics. *Int J Behav Med*. 2022;30:211–220. https://doi.org/10.1007/s12529-022-10085-7.
40. Joshy G, Khalatbari-Soltani S, Soga K, et al. Pain and its interference with daily living in relation to cancer: a comparative population-based study of 16,053 cancer survivors and 106,345 people without cancer. *BMC Cancer*. 2023;23:774. https://doi.org/10.1186/s12885-023-11214-5.
41. d'Ussel M, Sacco E, Moreau N, et al. Assessment of decision-making autonomy in chronic pain patients: a pilot study. *BMC Med Ethics*. 2024;25:97. https://doi.org/10.1186/s12910-024-01096-y.
42. Wang T, Molassiotis A, Chung BPM, et al. Unmet care needs of advanced cancer patients and their informal caregivers: a systematic review. *BMC Palliat Care*. 2018;17:96. https://doi.org/10.1186/s12904-018-0346-9.
43. Hauken MA, Larsen TMB. Young adult cancer patients' experiences of private social network support during cancer treatment. *J Clin Nurs*. 2019;28:2953–2965. https://doi.org/10.1111/jocn.14899.
44. Jakobsen K, Magnus E, Lundgren S, et al. Everyday life in breast cancer survivors experiencing challenges: a qualitative study. *Scand J Occup Ther*. 2018;25:298–307. https://doi.org/10.1080/11038128.2017.1335777.
45. Müller K, Fischer I, Koller M, et al. Special consultation hour for patients with cancer-related fatigue: study protocol of an observational study of a nationwide health care structure by the Bavarian Cancer Society (BKG) in Bavaria. *Psychother Psychosom Med Psychol*. 2023;73:231–239. https://doi.org/10.1055/a-1970-6457.
46. Folorunso SA, Ntekim A, Abdus-Salam AA, et al. Fatigue as a complicating factor in the recovery of breast cancer survivors treated at an oncology clinic in South West Nigeria: a case-control study. *Ecancermedicalscience*. 2022;16:1420. https://doi.org/10.3332/ecancer.2022.1420.
47. Salek M, Silverstein A, Tilly A, et al. Factors influencing treatment decision-making for cancer patients in low- and middle-income countries: a scoping review. *Cancer Med*. 2023;12:18133–18152. https://doi.org/10.1002/cam4.6375.
48. See MH, Sinnadurai S, Lai LL, et al. Outcomes after mastectomy with immediate breast reconstruction for breast cancer in a multiethnic, middle-income Asian setting. *Surgery (St Louis)*. 2021;170:1604–1609. https://doi.org/10.1016/j.surg.2021.08.001.
49. Ahn SK, Oh S, Kim J, et al. Psychological impact of type of breast cancer surgery: a national cohort study. *World J Surg*. 2022;46:2224–2233. https://doi.org/10.1007/s00268-022-06585-y.
50. Nair AG, Ko GTY, Semple JL, et al. Breast reconstruction use and impact on surgical and oncologic outcomes amongst inflammatory breast cancer patients-a systematic review. *Curr Oncol*. 2023;30:6666–6681. https://doi.org/10.3390/curroncol30070489.
51. Tang Q, Liu L, Mo J, et al. Comparative study on the perioperative situation and quality of life of patients with breast cancer treated by modified radical mastecto my and immediate latissimus dorsi flap breast reconstruction after modified radical mastectomy. *Journal of Clinical and Experimental Medicine*. 2020;19:1757–1760.
52. El-Baba RM, Schury MP. *Neuroanatomy, frontal cortex. Treasure Island, FL*. StatPearls Publishing; 2024.
53. Zhang Y, Hu X, Duan Y, et al. Latent profile analysis and influencing factors of sefl-advocacy of patients with gynecological malignant tumor. *J Nurs Adm*. 2024:287–293. https://doi.org/10.16460/j.issn1008-9969.2023.12.062.
54. Tan L, Fang P, Yu H, et al. Status quo self-advocacy in female cancer patients and its influencing factors: a 231-case study. *J Nurs*. 2023;30:62–66. https://doi.org/10.16460/j.issn1008-9969.2023.12.062.
55. Li X, Zou Y, Zhang Z, et al. Chemotherapy-related symptom networks in distinct subgroups of Chinese patients with gastric cancer. *Asia Pac J Oncol Nurs*. 2024;11:100366. https://doi.org/10.1016/j.apjon.2023.100366.
56. Fielding RA, Landi F, Smoyer KE, et al. Association of anorexia/appetite loss with malnutrition and mortality in older populations: a systematic literature review. *J Cachexia Sarcopenia Muscle*. 2023;14:706–729. https://doi.org/10.1002/jcsm.13186.
57. Saunders J, Smith T. Malnutrition: causes and consequences. *Clin Med*. 2010;10:624–627. https://doi.org/10.7861/clinmedicine.10-6-624.
58. Laird BJ, McMillan D, Skipworth RJE, et al. The emerging role of Interleukin 1β (IL-1β) in cancer cachexia. *Inflammation*. 2021;44:1223–1228. https://doi.org/10.1007/s10753-021-01429-8.
59. Li Y, Jiang Q, Wang L. Appetite regulation of TLR4-induced inflammatory signaling. *Front Endocrinol*. 2021;12:777997. https://doi.org/10.3389/fendo.2021.777997.
60. Cheung YT, Ng T, Shwe M, et al. Association of proinflammatory cytokines and chemotherapy-associated cognitive impairment in patients with breast cancer: a multi-centered, prospective, cohort study. *Ann Oncol*. 2015;26:1446–1451. https://doi.org/10.1093/annonc/mdv206.
61. Zhao J, Zuo H, Ding K, et al. Changes in plasma IL-1β, TNF-α and IL-4 levels are involved in chemotherapy-related cognitive impairment in early-stage patients with breast cancer. *Am J Transl Res*. 2020;12:3046–3056.
62. Shim EJ, Ha H, Suh YS, et al. Network analyses of associations between cancer-related physical and psychological symptoms and quality of life in gastric cancer patients. *Psycho Oncol*. 2021;30:946–953. https://doi.org/10.1002/pon.5681.
63. Deppermann S, Storchak H, Fallgatter AJ, et al. Stress-induced neuroplasticity: (mal) adaptation to adverse life events in patients with PTSD–a critical overview. *Neuroscience*. 2014;283:166–177. https://doi.org/10.1016/j.neuroscience.2014.08.037.
64. Lu H, Xie J, Gerido LH, et al. Information needs of patients with breast cancer: theory-generating meta-synthesis. *J Med Internet Res*. 2020;22:e17907. https://doi.org/10.2196/17907.
65. Mundle R, Afenya E, Agarwal N. The effectiveness of psychological intervention for depression, anxiety, and distress in prostate cancer: a systematic review of literature. *Prostate Cancer Prostatic Dis*. 2021;24:674–687. https://doi.org/10.1038/s41391-021-00342-3.
66. Heinen J, Bäuerle A, Schug C, et al. Mindfulness and skills-based eHealth intervention to reduce distress in cancer-affected patients in the reduct trial: intervention protocol of the make it training optimized. *Front Psychiatr*. 2022;28:1037158. https://doi.org/10.3389/fpsyt.2022.1037158.
67. Fawson S, Moon Z, Novogrudsky K, et al. Acceptance and commitment therapy processes and their association with distress in cancer: a systematic review and meta-analysis. *Health Psychol Rev*. 2023;18:456–477. https://doi.org/10.1080/17437199.2023.2261518.