

Network Analysis of Return-to-Work Readiness and Self-Efficacy Among Breast Cancer Patients by Return-to-Work Status: A Cross-Sectional Study

Qiu Huo

West China School of Public Health and West China Fourth Hospital, Sichuan University, Chengdu, Sichuan Province, 610041, China

Yunxia Pu

Department of Biotherapy Research, West China Hospital, Sichuan University, Chengdu, Sichuan Province, 610041, China;

huizhuo Deng

West China School of Public Health and West China Fourth Hospital, Sichuan University, Chengdu, Sichuan Province, 610041, China

Xianqiong Feng

fengxianqiong66@126.com

Department of Nursing, West China Hospital, Sichuan University, Chengdu, Sichuan Province, 610041, China

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Abstract

Purpose

Returning to work after breast cancer surgery is a complex psychosocial adaptation process. Return-to-work readiness and self-efficacy are central factors, but the interactions among their multiple components and their patterns across return-to-work statuses remain unclear. This study used network analysis to examine these constructs in patients who had and had not returned to work, identify central and bridge nodes, and compare the self-efficacy networks of the two groups.

Methods

This cross-sectional study used convenience sampling to recruit postoperative breast cancer patients from a tertiary hospital in Sichuan Province, China, including 323 patients who had not returned to work and 178 who had returned. Participants completed the Return-to-Work Readiness Scale (13-item version for those not working and 9-item version for those working) and the 11-item Return-to-Work Self-Efficacy Scale. Likert items were treated as approximately continuous. Regularized partial correlation networks were estimated with EBICglasso from Pearson correlation matrices. Strength centrality, bridge strength, and node predictability were calculated. Nonparametric and case-dropping bootstraps evaluated edge-weight accuracy and centrality stability, respectively. The Network Comparison Test (NCT) compared the two self-efficacy networks.

Results

The complete networks of the non-returned and returned groups retained 123 and 93 nonzero edges, respectively. In the non-returned group, RRTW-3 had the highest strength and RTWSE-2 had the highest bridge strength. In the returned group, RTWSE-10 had the highest strength and RRTW-22 had the highest bridge strength. The two 11-item self-efficacy networks did not differ significantly in structure ($M = 0.211$, $p = 0.811$) or global strength ($S = 0.109$, $p = 0.512$). The correlation-stability coefficients for strength centrality in the self-efficacy networks were 0.498 and 0.478 in the non-returned and returned groups, respectively.

Conclusions

The overall organization of the self-efficacy network did not differ statistically between patients who had and had not returned to work, although the descriptive rankings of central and bridge nodes varied by return-to-work status. Before return to work, assessment may emphasize readiness to act and beliefs related to coping with work stress. After return to work, assessment may emphasize work motivation, support needs for sustaining employment, and available energy. These network findings provide

potential directions for stage-specific vocational rehabilitation, but the node-ranking differences require replication in larger and longitudinal samples.

Implications for Cancer Survivors

For breast cancer survivors, vocational rehabilitation should continue after work resumption and address both return-to-work readiness and specific aspects of work-related self-efficacy. Assessment of work preparation, anticipated psychological interference, stress coping, energy, motivation, and perceived need for help may identify support needs related to both returning to and sustaining employment. Given the cross-sectional design and the acceptable but not good stability of node rankings, these items should inform comprehensive assessment rather than serve as stand-alone intervention targets.

1. INTRODUCTION

Breast cancer is a common malignancy among women, with approximately 2.26 million women diagnosed worldwide each year.[1] Its incidence is increasing in China.[2] In 2022, an estimated 357,200 new breast cancer cases occurred in China, making it the second most commonly diagnosed cancer among Chinese women.[3] Beyond threatening women's physical and psychological health, breast cancer imposes substantial socioeconomic burdens on families and society and may undermine family health and stability.[4] The peak age at diagnosis among adult Chinese women is reported to be 45–55 years,[5] and an estimated 70% of patients newly diagnosed with breast cancer are of working age.[6] Increasing life expectancy and delayed retirement in China mean that more cancer survivors will remain in the working-age population. Work-related concerns are therefore important to working-age patients with cancer.[7] Supporting return to work (RTW) after cancer diagnosis and treatment is a major concern for patients, families, and employers and is increasingly recognized as a public health and survivorship-care priority.[8]

Occupational rehabilitation remains at an early stage in China, and research specifically addressing RTW is still developing. Available evidence suggests that the proportion of Chinese patients returning to work after breast cancer surgery is substantially lower than that reported internationally,[9–13] possibly because of differences in cultural contexts and value systems.[14] In East Asian settings, family responsibilities, expectations surrounding social roles, and concerns about disclosing illness may create additional psychological conflict during social reintegration.[15] Chinese patients with breast cancer have also been reported to have relatively low RTW readiness and RTW self-efficacy.[16,17] Deficits in either may impede the first steps toward resuming work.

Crossing the threshold of initial RTW does not ensure favorable long-term employment. Although patients who have returned to work may demonstrate moderate work engagement,[18] their quality of working life may remain suboptimal and lower than that reported internationally; RTW self-efficacy is an important correlate of quality of working life.[19] Qualitative evidence also indicates that many cancer survivors have difficulty sustaining employment after RTW.[20] Similarly, a Chinese study found that

many patients were unable to maintain normal work or remained highly uncertain about sustaining demanding work.[21]

RTW is therefore a dynamic, multidimensional process. RTW readiness refers to a patient's overall preparedness to resume a previous occupation or begin new work during physical recovery or early rehabilitation after illness.[22] It may influence both the timing and success of RTW²³ and has been described as an important first step in reintegration.[24] RTW self-efficacy refers to confidence in returning to work and performing work-related tasks.[25] It is an important indicator of RTW outcomes^{26,27} and is closely associated with quality of life after work resumption.[19]

This study was informed by Social Cognitive Theory and the stage-based conceptualization of RTW readiness. Social Cognitive Theory proposes that behavior is shaped by reciprocal interactions among personal, behavioral, and environmental factors. Self-efficacy is a central component and reflects beliefs about one's ability to perform a particular behavior, manage difficulties, and achieve desired outcomes. [28,29] In the RTW context, readiness describes psychological and behavioral states across the formation of RTW intentions, preparation for action, and work maintenance.[22] RTW self-efficacy concerns confidence in completing tasks, coping with work stress, and managing work demands.[30] The constructs may be related, but they emphasize capability beliefs and stage-related RTW states, respectively, and should not be treated as identical.

Previous studies have generally examined relationships between RTW readiness and self-efficacy using correlations, regression models, or structural equation models based on total scores, subscale scores, or prespecified variable relations. These approaches are useful for estimating overall associations but do not readily describe the conditional association structure among multiple individual items. Network analysis offers a complementary approach by representing items as nodes and their regularized partial correlations, after conditioning on all other nodes, as edges.[31,32] Strength centrality summarizes a node's overall connectedness, whereas bridge strength identifies nodes with comparatively numerous or strong conditional connections to another psychological domain.[33] The NCT evaluates differences in network structure and global strength across groups.[34] Edges, centrality indices, and bridge strength in cross-sectional networks do not establish causality.[35]

Of note, data from 323 participants in the present cohort who had not returned to work were previously analyzed using latent profile analysis to identify person-level patterns of return-to-work readiness and self-efficacy and factors associated with profile membership [36]. That study adopted a person-centered approach, did not include the 178 participants who had returned to work, and did not examine conditional associations among individual scale items or compare self-efficacy networks across return-to-work statuses. The present study therefore reports a secondary analysis of the full cohort that addresses distinct research questions at a different level of analysis, focusing on item-level network structure, central and bridge nodes, and comparisons of the network formed by the self-efficacy items shared by the two return-to-work-status groups.

Building on this prior work and the remaining research gaps, the present study addressed the following three research questions:

RQ1: What complete network is formed by RTW readiness and self-efficacy among breast cancer patients who have not returned to work, and which items have relatively high strength centrality and bridge strength?

RQ2: What structural features characterize the RTW readiness and self-efficacy network among breast cancer patients who have returned to work, and which items have relatively high strength centrality and bridge strength?

RQ3: Do the networks of the 11 self-efficacy items shared by both groups differ in overall structure, global strength, specific edges, or node strength?

We estimated separate complete RTW readiness-self-efficacy networks for the non-returned and returned groups and compared the 11-item self-efficacy networks shared by both groups. The complete networks were interpreted only within groups because the groups completed different versions of the RTW Readiness Scale. The cross-sectional design also precludes causal inference and does not permit group differences to be interpreted as within-person changes before and after RTW.

2. METHODS

2.1 Design and participants

This cross-sectional survey used convenience sampling to recruit postoperative breast cancer patients from a tertiary hospital in Sichuan Province, China, between March and October 2024. Inclusion criteria were: (1) age 18–60 years; (2) histopathologically confirmed stage I-III breast cancer; (3) employment before diagnosis, defined as at least 4 hours per day and 20 hours per week; (4) completion of breast cancer surgery, with postoperative radiotherapy and/or chemotherapy ongoing or completed; (5) sufficient consciousness and comprehension to complete the questionnaire; and (6) informed consent and voluntary participation. Exclusion criteria were: (1) no more than 1 month since breast cancer surgery; (2) another malignant tumor; and (3) a psychiatric disorder, hearing impairment, or severe physical impairment.

Of 507 questionnaires distributed, 6 invalid questionnaires were excluded, leaving 501 valid questionnaires (valid response rate, 98.8%): 323 from patients who had not returned to work and 178 from patients who had returned. Data from the 323 participants who had not returned to work were included in a previous latent profile analysis [36]. The present study reports a secondary network analysis of the full cohort.

2. Measures

2.2.1 Participant characteristics

The researchers developed a questionnaire from the literature and expert opinion. It assessed demographic characteristics, including age, education, marital status, living arrangements, and economic status, as well as disease- and treatment-related characteristics, including time since diagnosis, TNM stage, treatment modalities, type of surgery, lymph-node surgery, and current treatment phase.

2.2.2 Return-to-Work Readiness Scale

The scale developed by Franche et al.[22] has two parts. The 13-item version for patients who have not returned to work contains four dimensions: precontemplation (items 1, 2, and 13), contemplation (items 9, 11, and 12), prepared for action-self-evaluative (items 4, 7, 8, and 10; item 7 is reverse scored), and prepared for action-behavioral (items 3, 5, and 6). Items are rated from 1 (strongly disagree) to 5 (strongly agree); dimension scores are summed, and the highest-scoring dimension indicates the respondent's stage. In this study, Cronbach's alpha values for the four dimensions were 0.750, 0.764, 0.776, and 0.712. The 9-item version for patients who have returned to work contains two dimensions: proactive maintenance (items 14–17) and uncertain maintenance (items 18–22; item 21 is reverse scored). Scoring is otherwise the same. Cronbach's alpha values for the two dimensions of the Chinese version were 0.743 and 0.734.

2.2.3 Return-to-Work Self-Efficacy Scale

The RTW Self-Efficacy Scale developed by Lagerveld et al.[30] is an 11-item unidimensional measure. Items are rated from 1 (strongly disagree) to 6 (strongly agree); items 2, 6, and 9 are reverse scored. The scale score is the item mean, with higher scores indicating greater self-efficacy. Cronbach's alpha values in the non-returned group, returned group, and combined sample were 0.912, 0.909, and 0.914, respectively.

2.3 Data collection

Data were collected using paper questionnaires at the breast disease center of a tertiary hospital in Sichuan Province, China. Participants included outpatients attending follow-up after surgery and adjuvant treatment, patients receiving postoperative chemotherapy, and patients receiving postoperative radiotherapy. Volunteers were recruited from the breast clinic, inpatient unit, and radiotherapy center. Three nursing master's students received standardized training and administered the questionnaires. Eligible participants were informed of the purpose, significance, and procedures of the study. After consent was obtained, participants received standardized instructions and completed the questionnaires independently. Investigators answered questions using standardized wording but did not influence responses; assistance was provided when a participant could not complete the questionnaire independently. Questionnaires were distributed and collected on site and were checked promptly for completeness and accuracy.

2.4 Statistical analysis

SPSS version 26.0 was used for descriptive statistics and group comparisons. Continuous variables are presented as mean $\pm$ standard deviation and were compared using independent-samples t tests or

Mann-Whitney U tests. Categorical variables are presented as frequencies and percentages and were compared using chi-square tests or Fisher's exact tests. Statistical significance was set at $\alpha = 0.05$. Network analyses were conducted in R version 4.5.1 using the qgraph, bootnet, network tools, and Network Comparison Test packages.

2.4.1 Node selection

Individual items from the RTW Readiness Scale and RTW Self-Efficacy Scale were treated as network nodes. Because the non-returned and returned groups completed different readiness items, separate complete networks were estimated and readiness items were not directly compared across groups. Participant characteristics were not included as nodes; they were used only to describe the sample and compare the groups.

2.4.2 Network estimation

Five- and six-category Likert items were treated as approximately continuous. Networks were estimated from Pearson correlation matrices using EBICglasso regularized partial correlations with the EBIC hyperparameter gamma set to 0.50. Pearson correlations were selected because some response categories had low frequencies, which could destabilize threshold estimation for polychoric correlations. EBICglasso combines the graphical least absolute shrinkage and selection operator with the extended Bayesian information criterion to select the regularization parameter and shrink weak associations to zero, thereby reducing false-positive edges.

Edge weights represent partial correlations after conditioning on all other nodes. Blue edges indicate positive associations, red edges indicate negative associations, and thicker edges indicate stronger associations.

2.4.3 Centrality and bridge strength

Strength centrality was calculated as the sum of the absolute weights of all edges incident on a node and describes its total direct association with other network nodes. To identify items connecting RTW readiness and self-efficacy, bridge strength was calculated with the bridge() function in the networktools package. Bridge strength was defined as the sum of the absolute edge weights connecting a node to nodes in the other community, with readiness and self-efficacy items specified a priori as two communities.

2.4.4 Node predictability

Node predictability was calculated from the precision matrix estimated by EBICglasso. For standardized variables, predictability of node i was defined as $R\text{-squared} = 1 - 1/K_{ii}$, where K_{ii} is the i th diagonal element of the precision matrix. It represents the proportion of a node's variance explained by all other nodes in the network.

2.4.5 Network accuracy and stability

Edge-weight accuracy was evaluated using 1,000 nonparametric bootstrap samples and 95% confidence intervals. Stability of strength centrality was evaluated using 1,000 case-dropping bootstrap samples, with approximately 5%-50% of cases dropped, and summarized with the correlation-stability (CS) coefficient. $CS > 0.25$ was considered acceptable and $CS \geq 0.50$ good. In each complete network, RRTW and RTWSE items were specified as two communities; bridge strength was calculated as the sum of absolute edge weights connecting a node to the other community, and its stability was evaluated using case-dropping bootstrap. Bridge strength was not calculated for the self-efficacy-only networks because they contained a single domain.

2.4.6 Between-group comparison

Because both groups completed the same 11-item self-efficacy measure, the NCT was used to compare the two self-efficacy networks with respect to network structure invariance, global strength invariance, specific edge weights, and node strengths. Tests used 1,000 permutations and $\alpha = 0.05$. Holm correction was applied to multiple comparisons of specific edges and node strengths.

2.5 Ethical considerations

The study protocol was reviewed and approved by the Biomedical Ethics Committee of West China Hospital, Sichuan University (Approval No. [2023] Annual Review (1834)). All data analyzed in the present study were collected under the approved protocol. The principles of respect, nonmaleficence, and confidentiality were followed throughout the study. Before questionnaire administration, participants were informed of the study purpose and procedures, the voluntary nature of participation, and their right to withdraw at any time. Data were collected only after informed consent had been obtained. All personal and clinical information was kept strictly confidential and used solely for research purposes.

3. RESULTS

3.1 Participant characteristics

The non-returned group comprised 323 participants aged 23–58 years (mean, 41.34 ± 6.43 years), and the returned group comprised 178 participants aged 23–58 years (mean, 41.21 ± 6.20 years). Participant characteristics are presented in Table 1.

Table 1
Characteristics of postoperative breast cancer patients (N = 501)

Variable	Category	Mean	n	%
Age		41.30 ± 6.34		
Education	Elementary school or below		11	2.20%
	Junior high school		67	13.37%
	High school/vocational		67	13.37%
	College		98	19.56%
	Bachelor's degree		219	43.71%
	Master's degree or above		39	7.78%
Marital status	Single		30	5.99%
	Married		435	86.83%
	Divorced		36	7.19%
Residence	City		422	84.23%
	Township		50	9.98%
	Rural area		29	5.79%
Living with parents	No		310	61.88%
	Yes		191	38.12%
Living with spouse	No		122	24.35%
	Yes		379	75.65%
Living with children	No		241	48.10%
	Yes		260	51.90%
Living alone	No		475	94.81%
	Yes		26	5.19%
Per-capita household income, CNY/month	≤ 3000		47	9.38%
	3000–5000		93	18.56%
	5000–8000		108	21.56%
	8000–10000		65	12.97%

Variable	Category	Mean	n	%
	≥ 10000		188	37.52%
Employee medical insurance	No		109	21.76%
	Yes		392	78.24%
Resident medical insurance	No		392	78.24%
	Yes		109	21.76%
Commercial insurance	No		388	77.45%
	Yes		113	22.55%
Government-funded medical care	No		499	99.60%
	Yes		2	0.40%
Self-funded care	No		495	98.80%
	Yes		6	1.20%
Number of children	0		68	13.57%
	1		295	58.88%
	2		135	26.95%
	3		3	0.60%
Time since diagnosis	< 1 year		361	72.06%
	1–3 years		116	23.15%
	> 3 years		24	4.79%
Clinical stage	Stage I		128	25.55%
	Stage II		268	53.49%
	Stage III		87	17.37%
	Unknown		18	3.59%
Radiotherapy	No		105	20.96%
	Yes		396	79.04%
Chemotherapy	No		57	11.38%
	Yes		444	88.62%
Endocrine therapy	No		165	32.93%
	Yes		336	67.07%

Variable	Category	Mean	n	%
Immunotherapy/targeted therapy	No		373	74.45%
	Yes		128	25.55%
Type of surgery	Breast-conserving		222	44.31%
	Mastectomy		141	28.14%
	Reconstruction		138	27.54%
Lymph-node surgery	None		38	7.58%
	Sentinel		253	50.50%
	Dissection		210	41.92%
Current treatment phase	Postoperative chemotherapy		164	32.73%
	Postoperative radiotherapy		225	44.91%
	Completed all treatments		112	22.36%

3.2 Baseline comparison by return-to-work status

The groups differed significantly in education, residence, per-capita household income, employee medical insurance, resident medical insurance, time since diagnosis, clinical stage, radiotherapy, type of surgery, and current treatment phase (all $p < 0.05$). No significant differences were observed for the other characteristics included in Table 2 (all $p > 0.05$).

Table 2
Comparison of participant characteristics by return-to-work status

Variable	Category/statistic	Non-returned (n = 323)	Returned (n = 178)	p value
Age, years	-	41.34 ± 6.43	41.21 ± 6.20	0.819
Education	Elementary school or below	9 (2.79%)	2 (1.12%)	< 0.001
	Junior high school	54 (16.72%)	13 (7.30%)	
	High school/vocational	54 (16.72%)	13 (7.30%)	
	College	59 (18.27%)	39 (21.91%)	
	Bachelor's degree	123 (38.08%)	96 (53.93%)	
	Master's degree or above	24 (7.43%)	15 (8.43%)	
Marital status	Single	19 (5.88%)	11 (6.18%)	0.896
	Married	282 (87.31%)	153 (85.96%)	
	Divorced	22 (6.81%)	14 (7.87%)	
Residence	City	259 (80.19%)	163 (91.57%)	0.004
	Township	38 (11.76%)	12 (6.74%)	
	Rural area	26 (8.05%)	3 (1.69%)	
Living with parents	No	198 (61.30%)	112 (62.92%)	0.794
	Yes	125 (38.70%)	66 (37.08%)	
Living with spouse	No	78 (24.15%)	44 (24.72%)	0.973
	Yes	245 (75.85%)	134 (75.28%)	
Living with children	No	155 (47.99%)	86 (48.31%)	1.000
	Yes	168 (52.01%)	92 (51.69%)	
Living alone	No	307 (95.05%)	168 (94.38%)	0.912
	Yes	16 (4.95%)	10 (5.62%)	
Per-capita household income, CNY/month	≤ 3000	41 (12.69%)	6 (3.37%)	0.001

Variable	Category/statistic	Non-returned (n = 323)	Returned (n = 178)	p value
	3000–5000	65 (20.12%)	28 (15.73%)	
	5000–8000	72 (22.29%)	36 (20.22%)	
	8000–10000	36 (11.15%)	29 (16.29%)	
	≥ 10000	109 (33.75%)	79 (44.38%)	
Employee medical insurance	No	83 (25.70%)	26 (14.61%)	0.006
	Yes	240 (74.30%)	152 (85.39%)	
Resident medical insurance	No	241 (74.61%)	151 (84.83%)	0.011
	Yes	82 (25.39%)	27 (15.17%)	
Commercial insurance	No	259 (80.19%)	129 (72.47%)	0.062
	Yes	64 (19.81%)	49 (27.53%)	
Government-funded medical care	No	322 (99.69%)	177 (99.44%)	1.000
	Yes	1 (0.31%)	1 (0.56%)	
Self-funded care	No	319 (98.76%)	176 (98.88%)	1.000
	Yes	4 (1.24%)	2 (1.12%)	
Number of children	0	43 (13.31%)	25 (14.04%)	0.702
	1	188 (58.20%)	106 (59.55%)	
	2	90 (27.86%)	45 (25.28%)	
	3	1 (0.31%)	2 (1.12%)	
Time since diagnosis	< 1 year	269 (83.28%)	92 (51.69%)	< 0.001
	1–3 years	48 (14.86%)	68 (38.20%)	
	> 3 years	6 (1.86%)	18 (10.11%)	
Clinical stage	Stage I	78 (24.15%)	50 (28.09%)	< 0.001
	Stage II	180 (55.73%)	88 (49.44%)	
	Stage III	65 (20.12%)	22 (12.36%)	

Variable	Category/statistic	Non-returned (n = 323)	Returned (n = 178)	p value
	Unknown	0 (0.00%)	18 (10.11%)	
Radiotherapy	No	54 (16.72%)	51 (28.65%)	0.002
	Yes	269 (83.28%)	127 (71.35%)	
Chemotherapy	No	31 (9.60%)	26 (14.61%)	0.123
	Yes	292 (90.40%)	152 (85.39%)	
Endocrine therapy	No	109 (33.75%)	56 (31.46%)	0.673
	Yes	214 (66.25%)	122 (68.54%)	
Immunotherapy/targeted therapy	No	243 (75.23%)	130 (73.03%)	0.665
	Yes	80 (24.77%)	48 (26.97%)	
Type of surgery	Breast-conserving	158 (48.92%)	64 (35.96%)	0.001
	Mastectomy	93 (28.79%)	48 (26.97%)	
	Reconstruction	72 (22.29%)	66 (37.08%)	
Lymph-node surgery	None	26 (8.05%)	12 (6.74%)	0.707
	Sentinel	159 (49.23%)	94 (52.81%)	
	Dissection	138 (42.72%)	72 (40.45%)	
Current treatment phase	Postoperative chemotherapy	130 (40.25%)	34 (19.10%)	< 0.001
	Postoperative radiotherapy	163 (50.46%)	62 (34.83%)	
	Completed all treatments	30 (9.29%)	82 (46.07%)	

3.3 Scores for return-to-work readiness and self-efficacy

3.3.1 Patients who had not returned to work

Among patients who had not returned to work, mean dimension scores were 2.57 ± 0.84 for precontemplation, 3.53 ± 0.70 for contemplation, 3.08 ± 0.74 for prepared for action-self-evaluative, and 3.36 ± 0.76 for prepared for action-behavioral. RRTW-12 (wanting advice on how to return to work) had the highest item score (3.65 ± 0.86), whereas RRTW-1 (believing that one cannot return to work) had the

lowest (2.29 ± 0.93). The total self-efficacy score was 45.95 ± 8.69 and the item mean was 4.18 ± 0.79 . RTWSE-3 (being able to define one's scope of work) had the highest score (4.63 ± 0.87), whereas reverse-scored RTWSE-6 had the lowest (3.42 ± 1.25 ; Table 3).

Table 3

Return-to-work readiness and self-efficacy scores among patients who had not returned to work (n = 323)

Construct	Item	Dimension	Item mean $\pm$ SD	Dimension total/mean
Return-to-work readiness	RRTW1: You believe that you cannot return to work	Precontemplation	2.29 $\pm$ 0.93	7.72/2.57
	RRTW2: You currently believe that there is no point in considering return to work	Precontemplation	2.71 $\pm$ 1.08	
	RRTW13: You currently believe that you do not need to return to work	Precontemplation	2.72 $\pm$ 1.07	
	RRTW9: You have been thinking about what you can do to return to work	Contemplation	3.48 $\pm$ 0.85	10.60/3.53
	RRTW11: You would like to identify more ways to return to work	Contemplation	3.47 $\pm$ 0.86	
	RRTW12: You would like advice on how to return to work	Contemplation	3.65 $\pm$ 0.86	
	RRTW4: Given your physical condition, you feel that you will soon be able to return to work	Prepared for action-self-evaluative	3.14 $\pm$ 0.99	12.30/3.08
	RRTW7 (reverse-scored): You are not yet ready to return to work	Prepared for action-self-evaluative	2.98 $\pm$ 1.04	
	RRTW8: You have found a way to balance your health and work so that you can return to work	Prepared for action-self-evaluative	3.10 $\pm$ 0.87	
	RRTW10: You have set a specific date for returning to work	Prepared for action-self-evaluative	3.09 $\pm$ 0.90	10.09/3.36
	RRTW3: You are actively preparing to return to work	Prepared for action-behavioral	3.51 $\pm$ 0.97	
	RRTW5: To return to work, you have been increasing your activity to rebuild physical strength	Prepared for action-behavioral	3.49 $\pm$ 0.93	
	RRTW6: You are preparing to return to work with help from	Prepared for action-behavioral	3.09 $\pm$ 0.97	

Construct	Item	Dimension	Item mean ± SD	Dimension total/mean
	others			
Return-to-work self-efficacy	RTWSE1: I can cope with difficulties at work	/	4.32 ± 1.13	
	RTWSE2 (reverse-scored): Because of my psychological state, I will be unable to complete my work tasks	/	4.17 ± 1.15	
	RTWSE3: I can define the scope of my work	/	4.63 ± 0.87	
	RTWSE4: I can complete my work tasks	/	4.39 ± 1.02	
	RTWSE5: When necessary, I can devote myself fully to work	/	4.49 ± 0.98	
	RTWSE6 (reverse-scored): I have no energy left for activities outside work	/	3.42 ± 1.25	
	RTWSE7: I can concentrate on my work	/	4.4 ± 0.95	
	RTWSE8: I can cope with work stress	/	4.03 ± 1.12	
	RTWSE9 (reverse-scored): I will be unable to handle potential problems at work (e.g., unexpected events)	/	3.76 ± 1.18	
	RTWSE10: I can motivate myself to complete my work	/	4.54 ± 0.93	
	RTWSE11: I can cope with the physical demands of work	/	3.78 ± 1.24	
	RTWSE item mean		4.18 ± 0.79	
	Total RTWSE Score (11 items)		45.95 ± 8.69	

3.3.2 Patients who had returned to work

Among patients who had returned to work, the proactive maintenance and uncertain maintenance mean scores were 3.89 ± 0.56 and 2.90 ± 0.67 , respectively. RRTW-14 had the highest item score (4.12 ± 0.62),

whereas reverse-scored RRTW-21 had the lowest (2.08 ± 0.76). The total self-efficacy score was 49.36 ± 8.08 and the item mean was 4.49 ± 0.73 . RTWSE-3 had the highest score (4.93 ± 0.71), whereas reverse-scored RTWSE-6 had the lowest (3.63 ± 1.41 ; Table 4).

Table 4

Return-to-work readiness and self-efficacy scores among patients who had returned to work (n = 178)

Construct	Item	Dimension	Item mean $\pm$ SD	Dimension mean $\pm$ SD
Return-to-work readiness	RRTW14: You are doing everything you can to remain at work	Proactive Maintenance	4.12 $\pm$ 0.62	3.89 $\pm$ 0.56
	RRTW15: You have learned how to manage illness-related problems in order to remain at work	Proactive maintenance	3.84 $\pm$ 0.79	
	RRTW16: You are taking steps to prevent stopping work again because of illness	Proactive maintenance	3.79 $\pm$ 0.82	
	RRTW17: You have found a way to balance your health and work so that you can remain at work	Proactive maintenance	3.80 $\pm$ 0.75	
	RRTW18: You have returned to work but are unsure whether you can sustain the work intensity	RRTW – Uncertain	3.60 $\pm$ 0.94	2.90 $\pm$ 0.67
	RRTW19: You are concerned that illness may cause you to stop working again	RRTW – Uncertain	3.57 $\pm$ 1.01	
	RRTW20: You find it difficult to remain at work because of the effects of illness	RRTW – Uncertain	2.60 $\pm$ 1.03	
	RRTW21 (reverse-scored): You have returned to work and work is progressing well	RRTW – Uncertain	2.08 $\pm$ 0.76	
	RRTW22: You think that you may need help to remain at work	RRTW – Uncertain	2.67 $\pm$ 1.06	
Return-to-work self-efficacy	RTWSE1: I can cope with difficulties at work	/	4.63 $\pm$ 0.96	/
	RTWSE2 (reverse-scored): Because of my psychological state, I will be unable to complete my work tasks	/	4.52 $\pm$ 1.03	/
	RTWSE3: I can define the scope of my work	/	4.93 $\pm$ 0.71	/
	RTWSE4: I can complete my work tasks	/	4.76 $\pm$ 0.87	/
	RTWSE5: When necessary, I can devote myself fully to work	/	4.83 $\pm$ 0.79	/

Construct	Item	Dimension	Item mean $\pm$ SD	Dimension mean $\pm$ SD
	RTWSE6 (reverse-scored): I have no energy left for activities outside work	/	3.63 $\pm$ 1.41	/
	RTWSE7: I can concentrate on my work	/	4.58 $\pm$ 0.97	/
	RTWSE8: I can cope with work stress	/	4.30 $\pm$ 1.17	/
	RTWSE9 (reverse-scored): I will be unable to handle potential problems at work (e.g., unexpected events)	/	4.12 $\pm$ 1.15	/
	RTWSE10: I can motivate myself to complete my work	/	4.79 $\pm$ 0.73	/
	RTWSE11: I can cope with the physical demands of work	/	4.26 $\pm$ 1.15	/
	RTWSE item mean	/	4.49 $\pm$ 0.73	/
	Total RTWSE Score (11 items)	/	49.36 $\pm$ 8.08	/

3.4 Complete psychosocial network in the non-retained group

3.4.1 Network structure

Figure 1 presents the complete network for the non-retained group. It included 13 readiness items and 11 self-efficacy items (24 nodes). Estimation from the Pearson correlation matrix using EBIC glasso ($\gamma = 0.50$) retained 123 nonzero edges, giving a density of 0.4457 (44.6% of 276 possible edges). Nonparametric bootstrap estimates of stronger edges were generally consistent with the sample estimates, whereas confidence intervals for some weaker edges were wide; edges close to zero should therefore be interpreted cautiously. Ranked by absolute edge weight, the strongest associations were RRTW-11–RRTW-12 ($w = 0.458$), RTWSE-7–RTWSE-8 ($w = 0.389$), RRTW-1–RRTW-2 ($w = 0.287$), RRTW-8–RRTW-10 ($w = 0.279$), and RRTW-5–RRTW-6 ($w = 0.270$). Cross-domain edges were generally weak; the largest in absolute magnitude were RRTW-1–RTWSE-2 ($w = -0.131$), RRTW-13–RTWSE-6 ($w = -0.098$), and RRTW-8–RTWSE-11 ($w = 0.081$).

3.4.2 Strength centrality

Figure 2 presents strength centrality in the complete network of the non-retained group. RRTW-3 had the highest strength (1.154), followed by RTWSE-4 (1.120) and RTWSE-8 (1.107); RRTW-9 had the lowest

strength (0.570). Thus, RRTW-3, RTWSE-4, and RTWSE-8 had comparatively high total connection strength and occupied prominent positions in this network.

3.4.3 Bridge strength

Bridge strength was calculated to identify nodes connecting the RTW readiness and self-efficacy domains (Table 5). In the non-returned group, RTWSE-2 had the highest bridge strength (0.276), followed by RRTW-1 (0.262), RTWSE-6 (0.221), and RTWSE-11 (0.218). These items concern the perceived effect of psychological state on task completion, perceived barriers to RTW, energy remaining outside work, and the physical demands of work, respectively, and had comparatively strong conditional associations across the two domains.

3.5 Complete psychosocial network in the returned group

3.5.1 Network structure

Figure 3 presents the complete network for the returned group. It included 9 readiness items and 11 self-efficacy items (20 nodes). Estimation from the Pearson correlation matrix using EBICglasso ($\gamma = 0.50$) retained 93 nonzero edges, giving a density of 0.4895 (48.9% of 190 possible edges). Ranked by absolute edge weight, the strongest associations were RTWSE-3–RTWSE-4 ($w = 0.348$), RRTW-17–RRTW-21 ($w = -0.322$), RRTW-14–RRTW-15 ($w = 0.316$), and RTWSE-1–RTWSE-4 ($w = 0.283$). The largest cross-domain associations in absolute magnitude were RRTW-20–RTWSE-2 ($w = -0.199$), RRTW-22–RTWSE-9 ($w = -0.186$), and RRTW-19–RTWSE-6 ($w = -0.183$). These associations were predominantly negative and should be interpreted in relation to item content and scoring direction.

3.5.2 Strength centrality

Figure 4 presents strength centrality in the complete network of the returned group. RTWSE-10 had the highest strength (1.248), followed by RRTW-17 (1.113) and RTWSE-4 (1.107); RRTW-18 had the lowest strength (0.550). Thus, RTWSE-10, RRTW-17, and RTWSE-4 had comparatively high total connection strength and occupied prominent positions in this network.

3.5.3 Bridge strength

In the returned group, RRTW-22 had the highest bridge strength (0.578), followed by RTWSE-6 (0.536), RTWSE-2 (0.460), and RRTW-17 (0.352; Table 5). RRTW-22, a readiness item, ranked highest and indicates that perceived need for help in sustaining work had comparatively strong cross-domain connections with multiple self-efficacy items.

In the descriptive rankings for both groups, RTWSE-2 and RTWSE-6 were among the three highest bridge nodes, suggesting that these items may have relatively strong cross-domain connections across RTW statuses.

Table 5
Four nodes with the highest bridge strength in each group

Rank	Non-returned (n = 323)	Bridge strength	Returned (n = 178)	Bridge strength
1	RTWSE2: Because of my psychological state, I will be unable to complete my work tasks	0.276	RRTW22: You think that you may need help to remain at work	0.578
2	RRTW1: You believe that you cannot return to work	0.262	RTWSE6: I have no energy left for activities outside work	0.536
3	RTWSE6: I have no energy left for activities outside work	0.221	RTWSE2: Because of my psychological state, I will be unable to complete my work tasks	0.460
4	RTWSE11: I can cope with the physical demands of work	0.218	RRTW17: You have found a way to balance your health and work so that you can remain at work	0.352
Note: RRTW, return-to-work readiness; RTWSE, return-to-work self-efficacy.				

3.6 Comparison of the self-efficacy networks

The NCT compared the 11-item self-efficacy networks of the non-returned and returned groups. Neither network structure ($M = 0.211$, $p = 0.811$) nor global strength ($S = 0.109$, $p = 0.512$) differed significantly. After Holm correction, none of the between-group differences in the 55 specific edges or 11 node strengths was significant. The self-efficacy networks are shown in Fig. 5. Case-dropping bootstrap yielded strength-centrality CS coefficients of 0.498 and 0.478 for the non-returned and returned groups, respectively; both were acceptable and close to 0.50. Edge-weight accuracy was evaluated from nonparametric bootstrap confidence intervals rather than an edge-weight CS coefficient.

3.7 Network accuracy and stability

Nonparametric bootstrap results showed that the bootstrap means of the stronger edges were generally consistent with the sample estimates, whereas the 95% confidence intervals for some weak, near-zero edges were relatively wide (Figures S1, S2, S5, and S6). These weak edges should therefore be interpreted cautiously. Case-dropping bootstrap analyses showed that the CS coefficients for strength centrality in the complete networks were 0.498 and 0.427 for the non-returned and returned groups, respectively (Figures S3 and S4). The corresponding coefficients for the self-efficacy networks were 0.498 and 0.478 (Figures S7 and S8). The bridge-strength CS coefficients for the complete networks were 0.449 in both groups (Figures S9 and S10). All coefficients exceeded 0.25, indicating acceptable stability, although none reached the criterion for good stability ($CS \geq 0.50$).

3.8 Node predictability

Mean node predictability was R-squared = 0.378 (range, 0.209–0.559) in the non-returned group and R-squared = 0.441 (range, 0.125–0.639) in the returned group. In the non-returned group, predictability was highest for RTWSE-8 (R-squared = 0.559) and lowest for RRTW-9 (R-squared = 0.209). In the returned group, predictability was highest for RTWSE-10 (R-squared = 0.639) and lowest for RRTW-18 (R-squared = 0.125). On average, a larger proportion of node variance was explained by other nodes in the returned-group network, although this difference is descriptive only (Figures 6).

3.9 Sensitivity analyses

With Pearson correlations and gamma = 0.25, the estimated networks were identical to the primary analysis. With cor_auto correlation matrices, edge-weight correlations with the primary Pearson self-efficacy networks were 0.976 and 0.971 in the non-returned and returned groups, respectively; corresponding Spearman correlations for strength rankings were 0.855 and 0.900. With threshold = TRUE, the two self-efficacy networks retained 22 and 19 nonzero edges, respectively. The highest-strength node in the non-returned group changed to RTWSE-4, whereas RTWSE-10 remained highest in the returned group. Across settings, NCT results showed no significant differences in network structure or global strength (Table 6). The main between-group conclusion was therefore robust, although the single highest centrality ranking in the non-returned group was sensitive to the estimation setting.

Table 6
Sensitivity analyses of self-efficacy network comparisons under alternative analytical settings

Analytical setting	M	p(M)	S	p(S)
Pearson, gamma = 0.50	0.211	0.811	0.109	0.512
Pearson, gamma = 0.25	0.211	0.817	0.109	0.597
cor_auto, gamma = 0.50	0.337	0.371	0.136	0.702
Pearson, threshold=TRUE	0.284	0.687	0.307	0.599
Note: M denotes the maximum edge-weight difference in network structure; S denotes the difference in global strength. All NCTs used 1,000 permutations.				

4. DISCUSSION

This study estimated separate networks of RTW readiness and self-efficacy among breast cancer patients who had and had not returned to work and compared the self-efficacy networks shared by both groups. Stronger edges in both complete networks were concentrated mainly within the same psychological domain, whereas cross-domain edges were generally weaker. Central and bridge-node rankings differed descriptively between groups, but the NCT found no between-group differences in self-efficacy network structure, global strength, specific edges, or node strength. Thus, the psychological content most prominent within each complete network may vary by RTW status, but there is currently insufficient evidence that the overall organization of self-efficacy changes after RTW. Because the design

was cross-sectional, the groups cannot be interpreted as the same patients observed sequentially before and after returning to work.

4.1 Structural features of the complete networks

The stronger edges in both networks occurred mainly within either readiness or self-efficacy, indicating that the constructs are related but not interchangeable. The relatively limited cross-domain connectivity suggests that believing oneself capable of working does not necessarily mean being ready to return, and strong RTW intentions may coexist with limited confidence in performing work. Clinical assessment should therefore consider readiness and self-efficacy separately rather than substituting a single total score for both.

In the non-returned group, the strongest edge connected RRTW-11 (wanting to identify more ways to return to work) and RRTW-12 (wanting advice on how to return; $w = 0.458$), both in the contemplation dimension. This pattern indicates a close link between independently exploring RTW strategies and seeking professional guidance. A qualitative study by Xu et al. [37] similarly found that patients with cancer drew on both active learning and external resources when rebuilding RTW self-efficacy. A scoping review by Singh et al. [38] also highlighted the value of psychosocial support for RTW self-efficacy. Vocational rehabilitation before RTW may therefore combine professional consultation with tools that support self-reflection and peer exchange.

RTWSE-7 (being able to concentrate at work) and RTWSE-8 (being able to cope with work stress) were also strongly connected in the non-returned group ($w = 0.389$). Confidence in maintaining concentration and coping with stress may vary together rather than independently. Fatigue, sleep disturbance, and psychological distress are common during breast cancer treatment [39] and may jointly shape judgments about concentration and tolerance of work pressure. Qualitative evidence also describes cognitive difficulties and work-related pressure as co-occurring concerns among breast cancer survivors considering RTW.[40] Pre-RTW vocational assessment should therefore consider fatigue, concentration, and psychological stress together.

In the returned group, RTWSE-3 (being able to define one's scope of work) was strongly connected with RTWSE-4 (being able to complete work tasks), linking clarity about responsibilities with confidence in task completion. Work adjustment after cancer depends not only on individual capacity but also on job demands, flexible arrangements, supervisor support, and work modification.[7] Occupational rehabilitation research further emphasizes negotiating duties that a patient can currently perform and adapting work arrangements to physical capacity.[41,42] Post-RTW support should therefore include clarification of responsibilities, workload negotiation, and appropriate task modification rather than relying solely on individual effort.

The strong edge between RRTW-14 (doing everything possible to remain at work) and RRTW-15 (having learned to manage illness-related problems to remain at work) linked perceived effort to sustain employment with the ability to manage disease- and treatment-related effects. Sustained employment

requires not only willingness to work but also symptom management and workplace adaptation. Treatment-related adverse effects, including fatigue, may continue after RTW and reduce work ability and quality of working life.[43] Patients may also experience renewed sick leave or work exit, with symptom burden and the work environment influencing sustainable RTW.[13] Occupational rehabilitation should therefore continue after work resumption and address symptoms, work ability, and job adaptation.

RRTW-17 (having found a way to balance health and work) was strongly and negatively connected with reverse-scored RRTW-21 in the returned group. The original wording of RRTW-21 indicates that work is progressing well; after reverse scoring, higher scores indicate poorer progress. Conditional on the other nodes, the negative edge therefore indicates that patients who were better able to balance health and work tended to report smoother work progress. This edge linked proactive and uncertain maintenance, suggesting that fit among health status, job demands, and workplace support may be important for sustaining work.[13,44] Follow-up after RTW should assess this balance and the need to modify work content, intensity, or hours.

Overall, prominent content in the non-returned network concerned RTW strategies and information needs, concentration and stress coping, and preparation for action. In the returned network, prominent content concerned responsibilities and task completion, symptom management, and balancing health with work demands. These within-group patterns suggest that assessment before RTW may emphasize readiness and anticipated work ability, whereas assessment after RTW may emphasize job adaptation and capacity to sustain employment.

4.2 Interpretation of high-centrality nodes

Unlike an individual edge, strength centrality summarizes a node's total connection with all other nodes. RRTW-3 (actively preparing to return to work) had the highest strength in the complete non-returned network, indicating that preparatory action was directly connected with multiple readiness and self-efficacy items. This finding is consistent with the transtheoretical view that movement from contemplation toward preparation and action is marked by initiation of concrete preparatory behaviors. [45] RRTW-3 may therefore be useful as a candidate assessment item for identifying patients who intend to return but have not begun practical preparation. Its value as an intervention target requires prospective evaluation.

In the returned group, RTWSE-10 (being able to motivate oneself to complete work) had the highest strength, indicating broad direct connections with other items in that network. After resuming work, the challenge may shift from gaining access to work toward maintaining engagement and employment. This is consistent with the maintenance and relapse-prevention focus of stage-based behavior-change models.[45] Some returned participants nevertheless remained in uncertain maintenance. Self-motivation may therefore be a relevant psychological resource, although a high cross-sectional centrality value alone does not establish that changing this item would improve outcomes.

4.3 Interpretation of bridge nodes

RTWSE-2 had the highest bridge strength in the non-returned group. Its original wording states that psychological state will prevent work-task completion; after reverse scoring, higher scores indicate stronger belief that psychological state will not interfere with task completion. RTWSE-2 was negatively connected with RRTW-1 (believing oneself unable to return to work) and positively connected with reverse-scored RRTW-7 (being ready to return). Judgments about whether psychological state will impair task completion may therefore connect work-related capability beliefs with RTW readiness. Psychological distress and RTW self-efficacy are both closely related to the RTW process in patients with cancer.[7,26] Assessment before RTW may explore concerns that anxiety, low mood, or other psychological states will interfere with work and provide psychological or vocational support matched to the identified concern.

RTWSE-6 ranked relatively high in bridge strength in both groups. Its original wording indicates having no energy for activities outside work; after reverse scoring, higher scores indicate better energy reserves after completing work. In the returned group, RTWSE-6 was negatively connected with RRTW-19 (concern about stopping work again because of illness), RRTW-22 (needing help to remain at work), and RRTW-18 (uncertainty about sustaining work intensity). Better energy reserves were therefore associated with fewer concerns and lower perceived support needs for work maintenance. Fatigue and other treatment-related effects can influence work ability and sustainable RTW.[7,13,43] Energy reserves may thus be an important assessment topic linking work self-efficacy with RTW or work-maintenance status.

RRTW-22 (possibly needing help to remain at work), an uncertain-maintenance item, had the highest bridge strength in the returned group. It was negatively connected with reverse-scored RTWSE-9 (being able to manage potential work problems), reverse-scored RTWSE-6 (having energy for nonwork activities), reverse-scored RTWSE-2 (psychological state not interfering with task completion), and RTWSE-1 (being able to cope with work difficulties). Thus, greater perceived need for help was conditionally associated with lower confidence across several work capabilities. Returning to work does not mark the end of vocational rehabilitation, and sustainable employment remains influenced by symptoms, work ability, and workplace support.[7,13] When a returned patient reports needing help to remain employed, assessment should identify the specific difficulty and consider symptom management, task modification, and workplace coordination.

RTWSE-2 and RTWSE-6 ranked among the three highest bridge nodes in both groups. This descriptive cross-group pattern suggests that beliefs about the effects of psychological state on task completion and about energy outside work may be relevant to links between work-related beliefs and RTW readiness or maintenance. However, the complete networks contained different readiness items and bridge-strength differences were not tested directly; the shared rankings should not be interpreted as proof of invariance across groups.

4.4 Comparison of the self-efficacy networks

The NCT found no significant between-group difference in self-efficacy network structure ($M = 0.211$, $p = 0.811$) or global strength ($S = 0.109$, $p = 0.512$). After Holm correction, no specific edge or node-strength

difference was significant. There is therefore insufficient evidence that the two groups have different patterns of conditional association among self-efficacy items.[34] The returned group had a higher mean self-efficacy score than the non-returned group, suggesting a difference in overall level rather than selective strengthening of a particular capability or association. Higher RTW self-efficacy has been associated with earlier RTW among patients with cancer,[25] although its independent predictive contribution may diminish after disease-, treatment-, and work-related factors are considered.[46] Self-efficacy should therefore be understood as an important psychological resource within the broader context of symptom burden, work ability, and the work environment. The cross-sectional design cannot determine whether higher self-efficacy facilitated RTW or whether actual work experience strengthened confidence in work ability.

4.5 Predictability, accuracy, and stability

Mean predictability indicated that the other nodes explained 37.8% of node variance in the non-returned network and 44.1% in the returned network. These values show that the modeled readiness and self-efficacy items captured a meaningful, but incomplete, proportion of each node's variance. Bootstrap results supported interpretation of stronger edges more than weak, near-zero edges. Centrality and bridge-strength CS coefficients were acceptable (> 0.25) but below the criterion for good stability ($> = 0.50$); consequently, exact node rankings should be treated as provisional and replicated in larger samples.

4.6 Clinical implications

These findings suggest that vocational rehabilitation assessment should consider specific readiness and self-efficacy content in addition to total scores. Before RTW, assessment may emphasize preparation for action, coping with work stress, perceived effects of psychological state on task completion, and energy reserves. After RTW, assessment may also address task completion, work motivation, help needed to sustain employment, fatigue, work hours, and job adaptation. The identified nodes are candidates for screening and individualized assessment, not established stand-alone intervention targets. Evidence on RTW rehabilitation suggests that graded work resumption, fatigue management, task modification, and coordination between healthcare services and employers may better match the multidimensional needs of patients with cancer than an intervention focused on a single psychological item [47,48].

4.7 Limitations

This single-center, cross-sectional study used convenience sampling and cannot establish temporal or causal relations between nodes; generalizability is limited. The groups completed different versions of the RTW Readiness Scale, precluding direct comparison of their complete networks. The NCT did not adjust for all potential covariates, so network features cannot be attributed solely to RTW status. The primary analysis treated Likert items as approximately continuous, and confidence intervals for some weak edges were wide. Finally, CS coefficients indicated acceptable rather than good stability, leaving

uncertainty in some node rankings. Multicenter longitudinal studies should replicate these findings and examine sustained RTW and quality of working life as outcomes.

4.8 Conclusions

The RTW readiness and self-efficacy networks of breast cancer patients who had and had not returned to work showed within-domain clustering. The shared 11-item self-efficacy networks did not differ significantly in overall structure, global strength, specific edges, or node strengths. Beliefs concerning work-stress coping, psychological state, energy reserves, task motivation, and help needed to sustain employment may inform vocational rehabilitation assessment, but the findings do not establish causal mechanisms or single intervention targets.

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Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Ethics Approval

The study received approval from the Medical Ethics Committee of the West China Hospital of Sichuan University (No. 2023-1834).

Consent to Participate

Informed consent was obtained from all participants.

Consent to Publish

Not applicable.

Data Availability

The data that support this study are available from the first author upon reasonable request.

Author Contributions

Qiu Huo: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Writing – original draft.

Yunxia Pu: Investigation; Data curation; Writing – review & editing.

Huizhuo Deng: Data curation; Formal analysis; Visualization; Writing – review & editing.

Xianqiong Feng: Conceptualization; Methodology; Supervision; Project administration; Writing – review & editing.

All the authors contributed to this work and have approved the final version.

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Figures

Non-returned group: Complete network

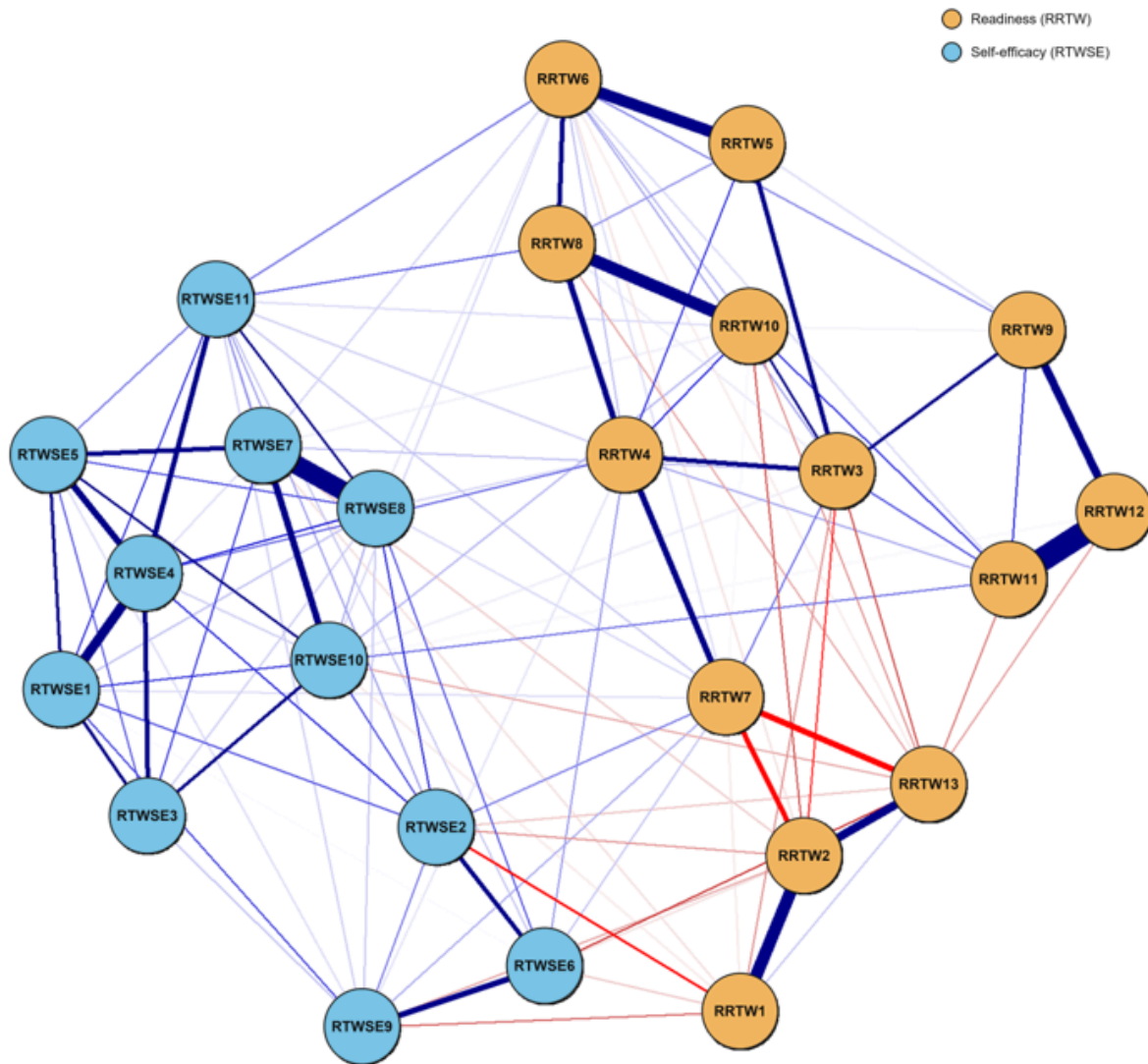


Figure 1

Complete network in the non-returned group

Note: RRTW, return-to-work readiness; RTWSE, return-to-work self-efficacy. Orange nodes represent readiness items, and blue nodes represent self-efficacy items. Blue edges indicate positive partial correlations, red edges indicate negative partial correlations, and edge width represents the absolute magnitude of the partial correlation. RTWSE-2, RTWSE-6, RTWSE-9, and RRTW-7 were reverse-scored.

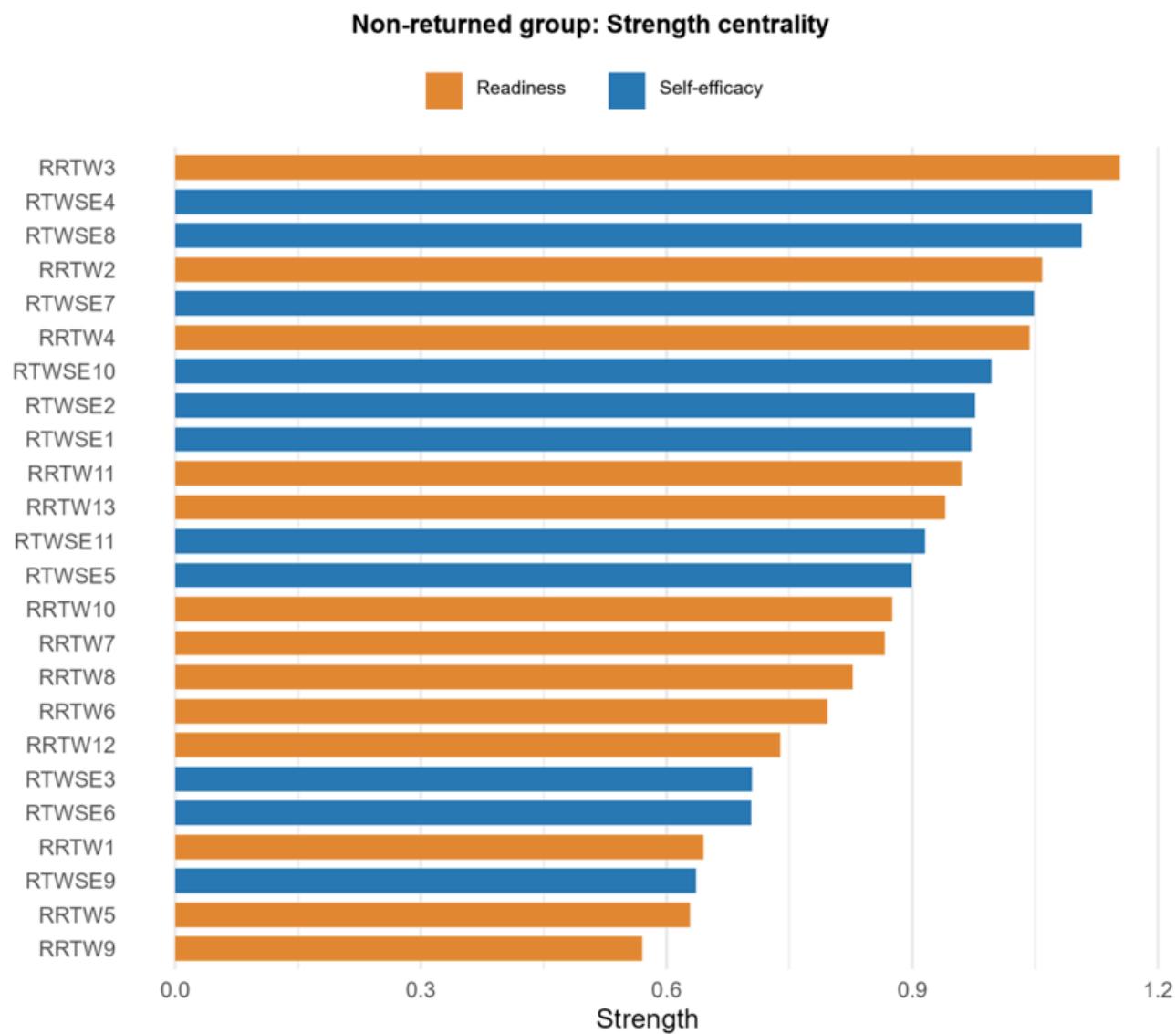


Figure 2

Strength centrality in the non-returned group

Note: RRTW, return-to-work readiness; RTWSE, return-to-work self-efficacy. Higher strength values indicate stronger total direct conditional associations with other network nodes.

Returned group: Complete network

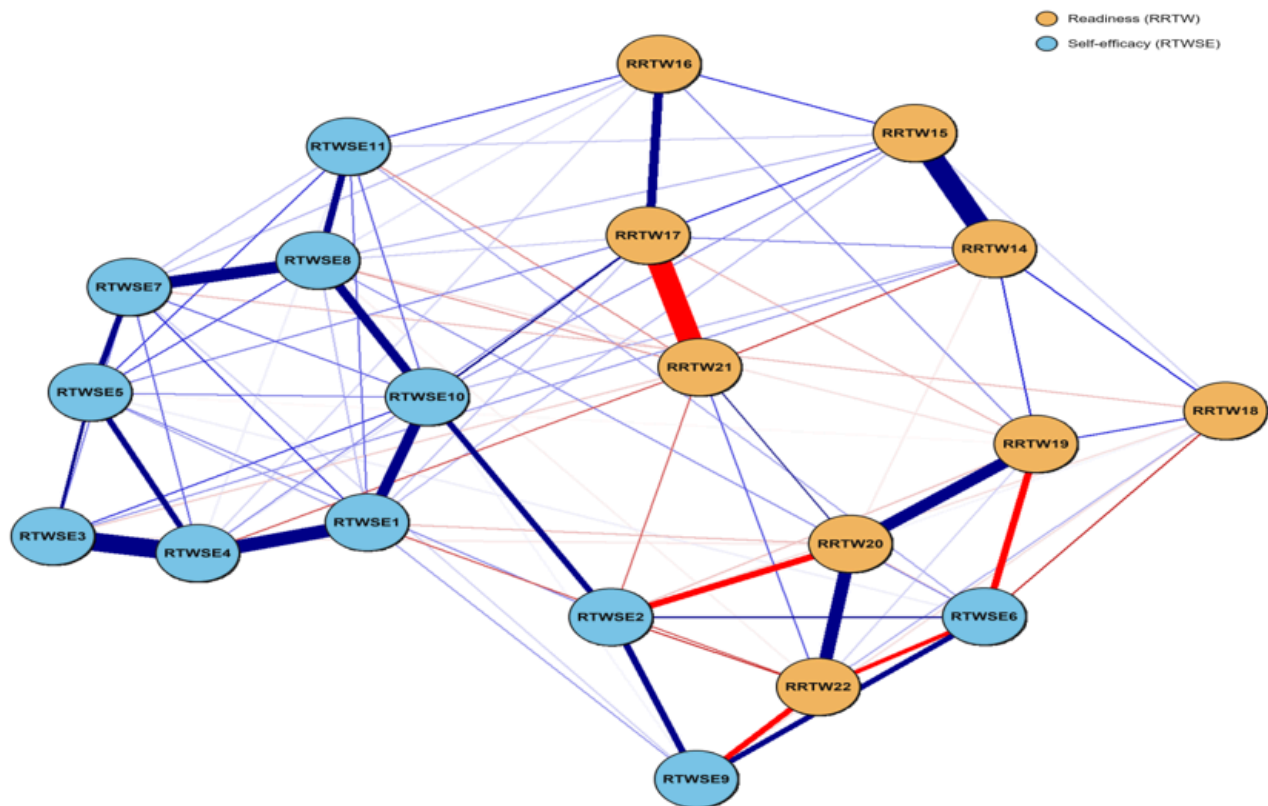


Figure 3

Complete network in the returned group

Note: RRTW, return-to-work readiness; RTWSE, return-to-work self-efficacy. Orange nodes represent readiness items, and blue nodes represent self-efficacy items. Blue edges indicate positive partial correlations, red edges indicate negative partial correlations, and edge width represents the absolute magnitude of the partial correlation. RTWSE-2, RTWSE-6, RTWSE-9, and RRTW-21 were reverse-scored.

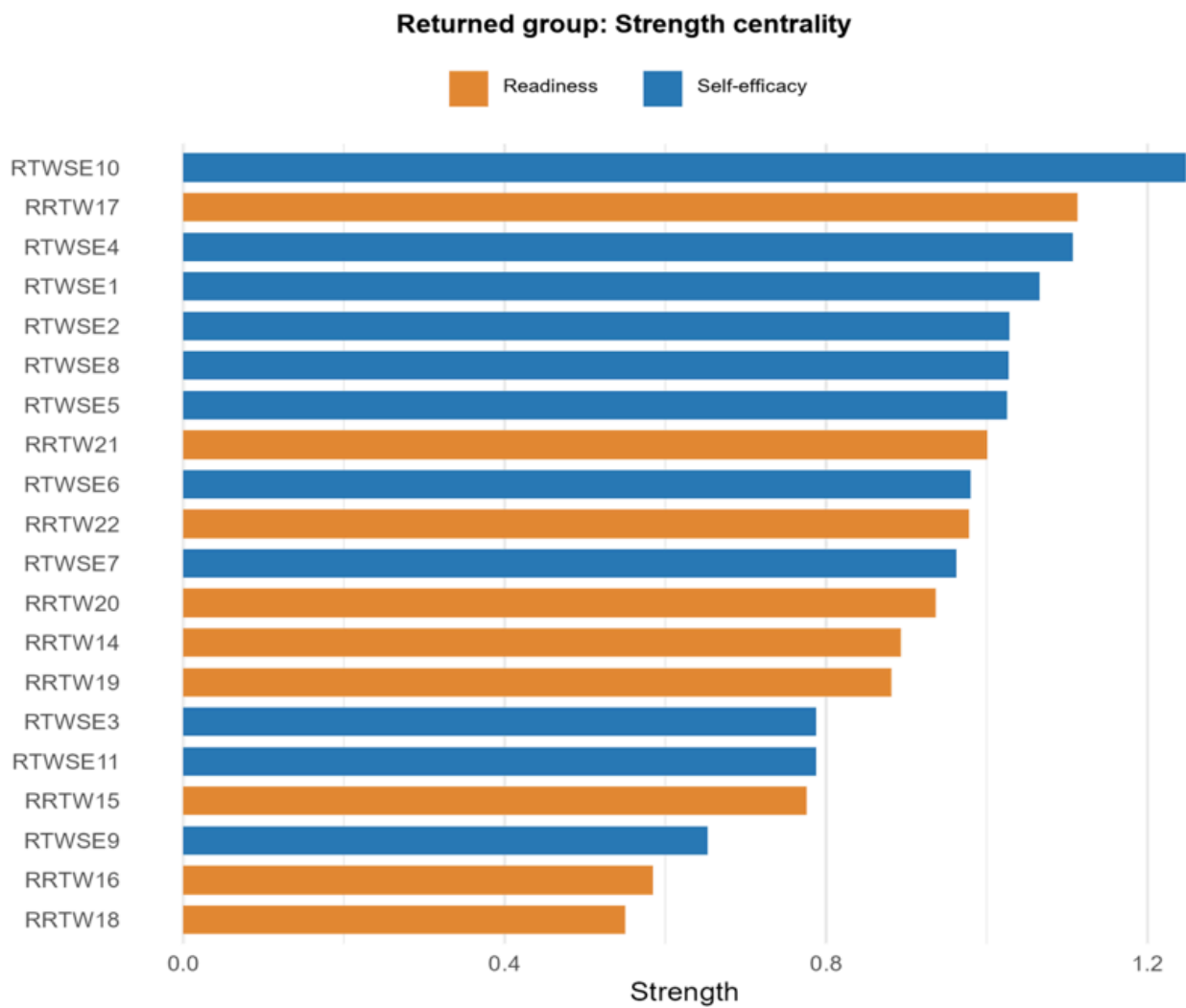
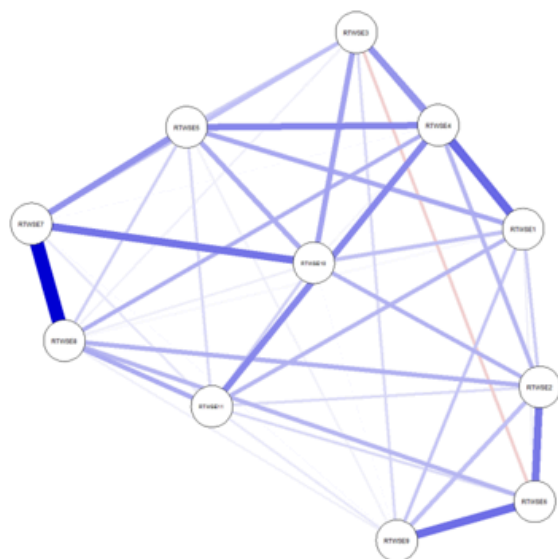


Figure 4

Strength centrality in the returned group

Note: RRTW, return-to-work readiness; RTWSE, return-to-work self-efficacy. Higher strength values indicate stronger total direct conditional associations with other network nodes.

a Non-returned group



b Returned group

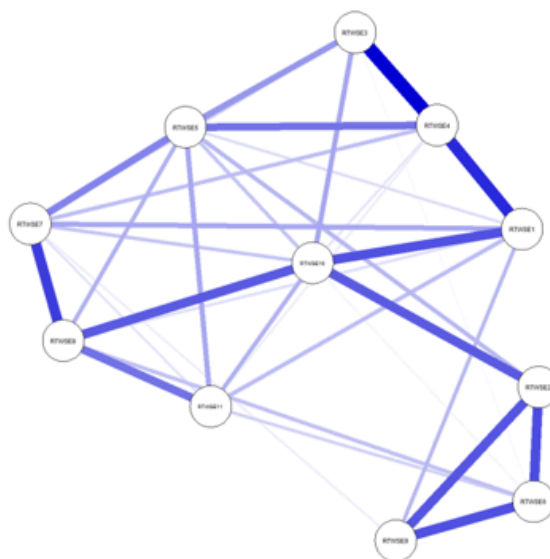


Figure 5

Self-efficacy networks in the non-returned (A) and returned (B) groups

Note: Blue edges indicate positive partial correlations, red edges indicate negative partial correlations, and edge width represents the absolute magnitude of the partial correlation. Both panels use the same node layout. RTWSE-2, RTWSE-6, and RTWSE-9 were reverse-scored in both panels.

a Non-returned group predictability

b Returned group predictability

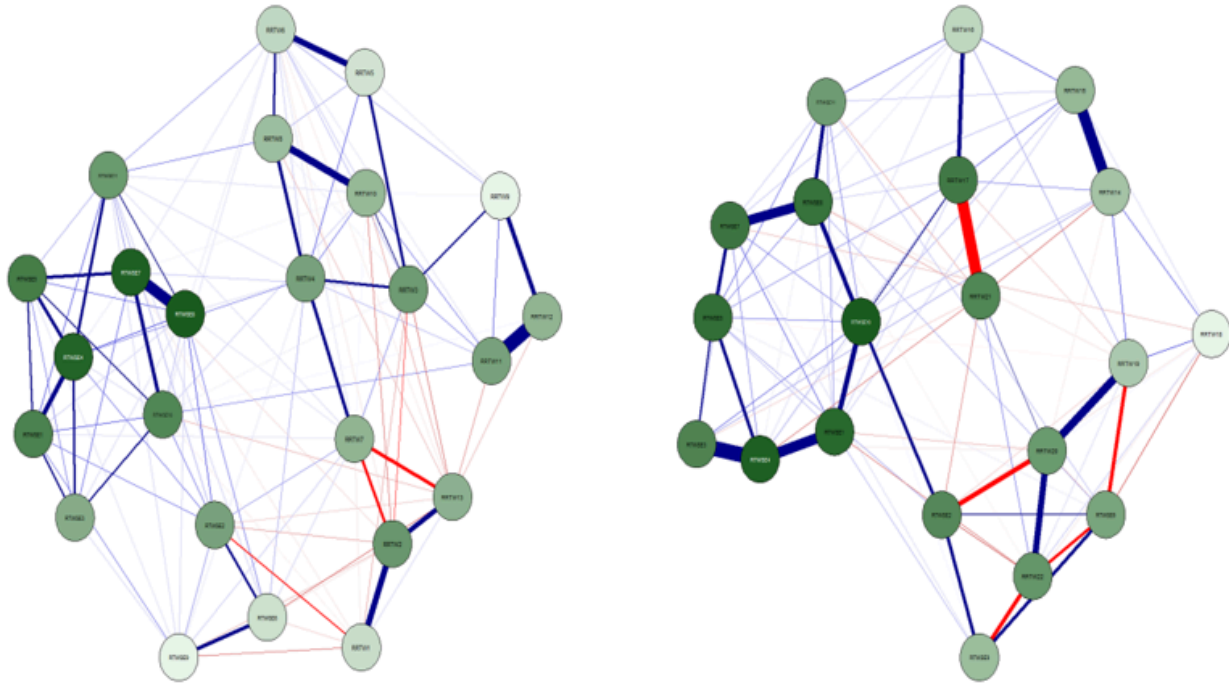


Figure 6

Node predictability in the non-returned (A) and returned (B) groups

Note: RRTW, return-to-work readiness; RTWSE, return-to-work self-efficacy. Darker green indicates higher predictability (R-squared). Blue edges indicate positive partial correlations, and red edges indicate negative partial correlations. RTWSE-2, RTWSE-6, and RTWSE-9 were reverse-scored in both panels; RRTW-7 and RRTW-21 were reverse-scored in panels A and B, respectively.

Supplementary Files

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- [SupplementaryFiguresS1S10.pdf](#)