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The changes of quality of life and their correlations with psychosocial factors following surgery among women with breast cancer from the post-surgery to post-treatment survivorship

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ABSTRACT

Objectives: This 14-month study aimed to examine the changes of quality of life following breast cancer surgery and associations of such changes with depression and anxiety levels, and protective factors (attachment styles in close relationship, and meaning in life) based on positive psychology theory.
Materials and methods: Women with breast cancer were recruited within one week of completion of breast cancer surgery. They were asked to complete several questionnaires to measure the generic and breast cancer specific quality of life, depression and anxiety levels, attachment styles in close relationship, and meaning in life. Assessments were performed at baseline (T0), T1 (the 2nd month), T2 (the 5th month), T3 (the 8th month), and T4 (the 14th month).
Results: While the generic functions of quality of life improve after surgery, no significant changes of the breast-specific functions were found during the 14-month follow up period. While physical, role, and social functions improved immediately after surgery, the improvements of emotional and cognitive functions began to occur at the 5th and the 8th months after surgery. Depressive symptoms predicted almost all general and breast-specific QOL functions and symptoms. Avoidant and anxious attachment styles were associated with the negative scores for breast-specific functions and symptoms.
Conclusion: Breast-specific functions, in particular body image and sexual function, remain unchanged with the passage of time following surgery. A psychological rehabilitation program aiming to reduce depressive symptoms and enhance secure attachment styles in close relationships needs to be established immediately following surgery and continue through the post-treatment survivorship stages.

1. Introduction

Higher survival rates after breast cancer diagnoses have increased the need for methods of restoring patients' quality of life [1]. Compared with the general population, after oncology treatment, breast cancer patients' physical functions improved over scores from before treatment, but their emotional and social functions were significantly worse, and all symptoms of distress (except pain) were higher than the general population [2]. Similarly, an 18-month study found that, while physical functioning was improved, cognitive, emotional, and social functioning of quality of life, treatment-related physical symptoms of pain and swelling in arm, and body image did not show significant improvement even 18 months following treatment [3]. Compared with healthy control group, the scores of emotional and social aspects of quality of life were lower in women with breast cancer [4]. The study found that

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6-months post-diagnosis, higher scores on the social aspect of quality of life predicted lower risk of mortality and recurrence rates, after controlling the clinical factors among breast cancer survivors due to the impacts of chronic social isolation on cortisol stress responses [5,6]. In summary, although physical functioning of quality of life improves with time after completing active cancer treatments, emotional and social functions and some breast cancer-specific symptoms are unlikely to have significant changes. More prospective studies are required to clarify the changes from active cancer treatment to the post-treatment survivorship period.

Breast cancer survivors experienced their frustration with body disfigurement after surgery, physical changes in appearance such as hair loss, and sexual problems after treatments [7,8]. However, they also experienced the positive impacts of breast cancer on their lives such as the improvement in the intimate relationships with their significant others, and purpose of life [8–10]. Positive psychology theory proposed that an individual pursuing the meaning in life is regarded as the personal strength because it can transform the individual's perceptions of their suffering from unfortunate to fortunate, as a result of the positive adjustment of life adversity [11]. A secure attachment style refers to secure emotional bonds in close relationships and insecure attachment styles influences an individual's negative perception of receiving sufficient social support [12,13]. The positive psychology interventions aiming at enhancing meaning in life and secure attachment style could produce the good quality of life [14]. In our previous 14-month follow up study, the lower scores of the presence of meaning in life predicted more severe depressive symptoms among breast cancer survivors [15]. Pursing the purpose in life was also positively associated with satisfaction with life among cancer patients [16]. Meaning in life could enhance life adaptation skills and quality of life among cancer patients [17]. The review study concludes that secure attachment styles influence cancer patients' positive views of their experiences of social interactions [18]. Breast cancer patients' perceptions of lower social supports were also associated with lower quality of life [19–21]. A meta-analysis revealed that the perception of higher social support, larger social networks, and being married were all correlated with a lower risk of cancer mortality [22].

A review study found that there was a trend of the increase of depressive symptoms for women with breast cancer one year after diagnosis [23]. Depressive symptoms after breast cancer patients completing active cancer treatments remained unchanged during the 1.5-year follow up period [24]. Depression and anxiety were the main predictors of quality of life among breast cancer patients undergoing active cancer treatments and long-term survivors [25,26]. The impacts of adjuvant treatments on quality of life among breast cancer patients were inconsistent. In a review study from Asia, the breast cancer patients receiving chemotherapy had poorer quality of life [20,21,27,28]. However, there were no significant associations of clinical factors (types of treatments) with quality of life among breast cancer patients who were undergoing treatments [2].

This 14-month study aimed to examine the changes of quality of life following breast cancer surgery to the post-treatment survivorship period and their associations with depression and anxiety levels, and protective factors (attachment style in close relationship, meaning in life) based on positive psychology theory after controlling the clinical variables.

2. Methods

2.1. Sample

This was a prospective longitudinal study of quality of life in breast cancer patients. Chinese women with breast cancer were recruited at the inpatient unit from the department of surgery of the general hospital which is located in north area and is one of the biggest breast cancer centers in Taiwan. The study periods were between August 2015 and December 2017. The inclusion criteria were women between 20 and 65 years old who had completed breast cancer surgery within one week. The participants were excluded if they had a history of other types of cancer. They were asked to complete self-report questionnaires at a baseline assessment T0 (within one week of completion of breast cancer surgery), and follow ups after surgery: T1 (the 2nd month), T2 (the 5th month), T3 (the 8th month), and T4 (the 14th month) to explore the changes of QOL from the post-surgery, active cancer treatments (chemotherapy or/and radiotherapy) to the post-treatment survivorship period. A total of 83 participants were recruited at T0 (baseline) and the numbers of the participants during the follow up period were 63 at T1, 63 at T2, 63 at T3, 61 at T4 after the attrition rates of 20 at T1, 0 at T2, 0 at T3, and 2 at T4. As indicated in Table 1,

Table 1
Demographic and clinical characteristics of breast cancer women (n = 83).

Characteristics	n (%)
Age	
Mean (SD)	49.50 (9.02)
Range	30–64
Marital status	
Without partner	33 (39.8%)
With partner	50 (60.2%)
Education	
High school graduate and below	5 (6%)
Bachelor and above	78 (94%)
Working status	
Unemployed	24 (28.9)
Employed	59 (71.1%)
Religion	
Without	20 (24.1%)
With	63 (75.9%)
Cancer stage	
0	14 (16.9%)
I	34 (41.0%)
II	27 (32.5%)
III	5 (6%)
IV	2 (2.4%)
Not clear	1 (1.2%)
Estrogen receptor (ER)	
Negative	17 (20.5%)
Positive	66 (79.5%)
Progesterone receptor (PR)	
Negative	21 (26.6%)
Positive	58 (73.4%)
Her-2 neu	
0	12 (15.6%)
1+	13 (16.9%)
2+	32 (41.6%)
3+	20 (26%)
Type of surgery	
Modified radical mastectomy	27 (32.5%)
Breast conservation	56 (67.5%)
Chemotherapy	
No	41 (49.4%)
Yes	42 (50.6%)
Radiotherapy	
No	43 (51.8%)
Yes	40 (48.2%)
Targeted therapy for HER2-positive	
No	64 (77.1%)
Yes	19 (22.9%)
Hormone therapy	
No	32 (39%)
Yes	50 (61%)
Duration between participation and completing active cancer treatments (chemotherapy or/and radiotherapy) mean ± SD (ranges), months	3.8 ± 4.5 (0 −12.4)

study participants were mainly in middle age, had a partner, were highly educated, and were employed. Most were at an early stage of breast cancer (0, I and II, 90.4%), ER and PR positive and Her-2 negative. Almost 70% of the patients received breast conservation surgery, about half of the patients received chemotherapy and radiotherapy, over sixty percent of them received hormone therapy, and less than 30% received target therapy.

2.2. Data collection

The researcher's assistant explained the purpose, risks, and benefits of the study to the prospective participants. After the participants gave their written consent, the assistant administered the self-reported questionnaires to them. European Organization for Research and Treatment of Cancer Core Cancer Quality of Life Questionnaire (EORTC QLQ-C30) [29] consists of 33 items, produces five functional scales (physical, role, cognitive, emotional, and social), three symptom scales (fatigue, pain, and nausea or vomiting), and three global health items. The item scores were transformed to a scale from 0 to 100 indicating higher scores for higher levels of functions and symptom distress. We found good internal consistency for the general health, functional, and symptom scales in this study (Cronbach's alpha = 0.892, 0.778 and 0.770, respectively).

Breast Cancer-Specific Complementary Measure (EORTC QLQ-BR23) comprises four functional scales (body image, sexual functioning and enjoyment, and future perspective) and four symptom scales (side-effects of systemic therapy, breast symptoms, referring to pain, swelling, oversensitivity, and skin problems in the breast; arm symptoms referring to swelling in arm or hand, arm or shoulder pain, and difficulty in moving the arm; and hair loss). Only the items for the sexual scales are scored positively with higher scores representing a higher level of sexual functioning and enjoyment. Two items (to what extent you were interested in sex and you were sexually active) measures sexual functioning while one single item (extent to which sex is enjoyable for you) assesses sexual enjoyment. Sexual enjoyment was reported only for those that had resumed sexual functioning. We found adequate internal consistency for both the functional and symptom scales (Cronbach's alpha = 0.693 and 0.825, respectively). The Beck Depression Inventory-II (BDI-II) scale [30] consists of 21 items and has total scores ranging from 0 to 63 with good-to-excellent internal consistency (Cronbach's alpha = 0.906). The State Trait Anxiety Inventory (STAI) [31] consists of 20 items with higher scores indicating higher levels of anxiety state. STAI had good internal consistency (STAI alpha = 0.957). The Experiences in Close Relationships-Revised (ECR-R) scale [32] consists of an 18-item anxiety attachment style assessing fear of rejection and abandonment by others, and an 18-item avoidant style assessing discomfort with closeness and dependency or a reluctance to be intimate with others. Higher scores indicate more insecure attachment styles. We found good internal consistency for anxiety and avoidant types of attachment subscales (0.934 and 0.938). Meaning of Life Questionnaire (MLQ) [33] includes a five-item MLQ-Presence scale, measuring the subjective sense that one's life is meaningful, and a five-item MLQ-Search scale, measuring one's drive and orientation toward finding meaning in life. Our results show adequate internal consistency (MLQ-Presence scale alpha = 0.932; MLQ-Search scale alpha = 0.889).

2.3. Statistical analysis

Multivariable modelling using linear generalized estimating equations (GEE) analysis was used to identify the main predictor for the changes of overall and breast-specific QOL during the 14-month follow-up. An independent working correlation structure was applied to adjust for within-subject correlation by modelling changes over time rather than absolute values at different time points. Time was modeled as a categorical variable over the time course, and the potential predictors were centered at their mean values in the GEE model to obtain interpretable regression coefficients. Estimated regression coefficients are presented with beta coefficient values, standard error, and *p*-values. All statistical tests performed were two-sided and considered significant at a *p*-value < 0.05.

2.4. Ethical approval

The study was approved by Research Ethics Committee, National Taiwan University Hospital (No. 201303065RIND).

3. Results

3.1. Changes of overall quality of life (QOL) following the post-surgery

As indicated in Table 2, GEE analysis indicated that the scores of overall function and global health status significantly increase across the 14-month follow-up. Physical, role, and social functions all significantly increase across 14 months. For emotional function, there was no significant improvement until at the 5th month after surgery (T2), (T1: $\beta = 4.33$, SE = 2.25, $p = 0.054$; T2: $\beta = 6.40$, SE = 2.61, $p = 0.014$; T3: $\beta = 7.74$, SE = 2.74, $p = 0.005$; T4: $\beta = 6.24$, SE = 2.82, $p = 0.027$). For cognitive function, significant increases after post-surgery were evidenced at T3 (8th) (T1: $\beta = 1.66$, SE = 2.33, $p = 0.475$; T2: $\beta = 1.93$, SE = 2.70, $p = 0.476$; T3: $\beta = 5.91$, SE = 2.84, $p = 0.038$; T4: $\beta = 3.99$, SE = 2.92, $p = 0.172$).

3.2. Changes of breast-specific quality of life (QOL) following the post-surgery

As indicated in Table 2, there were no significant changes in breast-specific function during follow ups ($p > 0.05$). Sexual functioning and sexual enjoyment remained unchanged over 14 months ($p > 0.05$). There were significant increases of positive future perspective during the 14-month follow up period (T1: $\beta = 9.65$, SE = 3.93, $p = 0.014$; T2: $\beta = 14.41$, SE = 3.86, $p < 0.001$; T3: $\beta = 13.36$, SE = 3.75, $p < 0.001$; T4: $\beta = 13.52$, SE = 4.17, $p = 0.001$). Compared with the baseline, body image remained unchanged across 14 months (T1: $\beta = -2.71$, SE = 2.77, $p = 0.329$; T2: $\beta = -2.18$, SE = 2.81, $p = 0.438$; T3: $\beta = 1.78$, SE = 2.79, $p = 0.523$; T4: $\beta = 2.90$, SE = 2.94, $p = 0.324$).

Table 2 shows that except hair loss, there were significant reductions in breast-specific symptoms (side effects, breast, and arm symptoms) ($p < 0.001$). As noted, significant reductions in side effects occurred at T2 (5th), T3 (8th), and T4 (14th) after post-surgery (T1: $\beta = 2.64$, SE = 2.20, $p = 0.23$; T2: $\beta = -3.77$, SE = 1.84, $p = 0.041$; T3: $\beta = -5.59$, SE = 1.78, $p = 0.002$; T4: $\beta = -6.83$, SE = 1.89, $p < 0.001$).

3.3. The psychosocial predictors of changes in quality of life (QOL)

Table 3 indicates that after controlling clinical and demographic data, increases of BDI-II depressive symptoms were correlated with lower scores of overall QOL function, all aspects of functions (physical, role, emotional, cognitive, and social functions), and global health status during the 14-month follow up period. In addition to BDI-II depressive symptoms, increased levels of STAI anxiety status and ECR-R avoidant attachment style in close relationship were associated with lower emotional function, while reductions of STAI anxiety status and increases of MLQ search

Table 2
The mean and standard deviations (SD) of main variables at five measurement times during 14 months follow up (n = 83).

QOL dimensions	T0 Mean (SD)	T1 Mean (SD)	T2 Mean (SD)	T3 Mean (SD)	T4 Mean (SD)	Statistical analysis
QOL Function	355.78 (6.57)	400.09 (7.27)	419.73 (7.47)	425.87 (7.56)	428.39 (7.67)	($X^2 = 80.74$, $P < 0.001$***)
Physical function	81.70 (1.22)	86.89 (1.34)	87.99 (1.38)	90.31 (1.40)	91.47 (1.42)	($X^2 = 36.59$, $P < 0.001$***)
Role function	62.35 (2.22)	84.64 (2.52)	89.29 (2.55)	88.14 (2.56)	91.31 (2.60)	($X^2 = 108.89$, $P < 0.001$***)
Emotional function	73.20 (1.85)	77.54 (2.09)	79.61 (2.13)	80.94 (2.14)	79.45 (2.17)	($X^2 = 9.13$, $P = 0.058$)
Cognitive function	76.61 (1.92)	78.28 (2.17)	78.55 (2.20)	82.53 (2.21)	80.60 (2.25)	($X^2 = 4.90$, $P = 0.297$)
Social function	62.03 (2.22)	71.51 (2.52)	83.29 (2.56)	83.25 (2.57)	85.21 (2.61)	($X^2 = 63.98$, $P < 0.001$***)
QOL Symptoms	201.26 (9.28)	156.18 (10.32)	129.39 (10.59)	109.74 (10.69)	111.62 (10.85)	($X^2 = 56.48$, $P < 0.001$***)
Global health	47.54 (2.15)	59.02 (2.45)	62.29 (2.48)	62.91 (2.48)	64.50 (2.52)	($X^2 = 36.38$, $P < 0.001$***)
Breast-specific Function	247.78 (7.94)	260.08 (8.44)	264.47 (8.33)	264.98 (8.27)	264.69 (8.63)	($X^2 = 4.15$, $P = 0.385$)
Body image	74.00 (2.76)	71.29 (3.39)	71.82 (3.41)	75.79 (3.44)	76.91 (3.18)	($X^2 = 9.93$, $P = 0.042$)*
Sexual functioning	84.32 (1.73)	85.44 (1.96)	82.53 (2.09)	82.01 (2.31)	85.24 (2.11)	($X^2 = 8.78$, $P = 0.067$)
Sexual enjoy[a]	60.00 (3.97)	59.72 (4.38)	64.19 (2.98)	57.47 (3.94)	62.96 (3.63)	($X^2 = 4.13$, $P = 0.389$)
Future perspective	41.66 (3.16)	51.32 (3.41)	56.08 (3.24)	55.02 (3.27)	55.19 (3.26)	($X^2 = 15.20$, $P = 0.004$)**
Breast symptoms	127.66 (7.71)	102.93 (8.81)	79.53 (10.16)	83.02 (9.96)	73.64 (11.39)	($X^2 = 25.14$, $P < 0.001$***)
Side effects	22.44 (1.61)	25.09 (2.11)	18.66 (1.49)	16.85 (1.31)	15.61 (1.55)	($X^2 = 24.24$, $P < 0.001$***)
Breast symptoms	26.98 (1.88)	20.23 (2.18)	15.21 (1.71)	16.26 (1.53)	14.07 (1.96)	($X^2 = 35.86$, $P < 0.001$***)
Arm symptoms	32.53 (2.16)	16.22 (2.05)	14.99 (1.91)	13.40 (1.71)	15.30 (2.47)	($X^2 = 71.44$, $P < 0.001$***)
Hair loss	31.66 (4.70)	36.66 (5.95)	24.24 (6.49)	24.63 (5.50)	20.37 (6.99)	($X^2 = 5.23$, $P = 0.264$)

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$.
[a] Noted: The results of sexual enjoyment was reported only for those that had resumed sexual functioning (n = 43).

Table 3
The clinical and psychosocial factors predicting the changes in overall quality of life over 14 months in multivariate GEE model (n = 83).

QOL dimensions	Predictors	Beta	95% CI for regression coefficients	*p*
QOL Function	With chemotherapy Without[0]	−23.70	−42.64~-4.75	0.014
	With employed status Without[0]	18.35	2.00–34.71	0.028
	BDI	−3.52	−4.75~-2.28	<0.001
Physical function	With employed status Without[0]	5.11	.99–9.23	0.015
	BDI	-.35	-.62~-.09	0.008
Role function	BDI	-.85	−1.37~ −.33	0.001
Emotional function	With radiotherapy without[0]	5.11	.68–9.53	0.024
	With hormone therapy Without[0]	4.99	1.43–8.56	0.006
	STAI	-.72	-.94~-.50	<0.001
	BDI	-.54	-.85~-.23	0.001
	ECR-R avoidant type	-.08	-.16~-.003	0.042
Cognitive function Social function	BDI	−1.11	−1.53~-.70	<0.001
	With chemotherapy Without[0]	−13.32	−19.80~-6.85	<0.001
	With hormone therapy Without[0]	7.91	1.81–14.00	0.011
	With employed status Without[0]	6.36	.74–11.97	0.026
	BDI	-.89	−1.37~-.40	<0.001
Global health	With hormone therapy Without[0]	7.71	1.71–13.72	0.012
	Conservative surgery Modified radical mastectomy[0]	7.67	.37–14.98	0.039
	STAI	-.39	-.73~-.05	0.021
	BDI	-.72	−1.19~-.24	0.003
	LM search	.43	.09~.77	0.013
QOL Symptoms	BDI	4.89	3.07–6.72	<0.001
	ECR-R avoidant type	.93	.41–1.44	<0.001

0 as reference group.
Multivariable modelling using linear generalized estimating equations (GEE) was used to identify the main predictor for overall QOL. Each GEE model included the factor 'time', the demographic data (age and employed status), the clinical factors (cancer stage, types of treatments: surgery, chemotherapy, radiotherapy, target therapy, hormone therapy), the psychosocial factors (BDI-II, STAI, ECR-R anxiety and avoidant types, presence and search aspects of meaning in life).

aspect of meaning in life were correlated with higher global health status. The increases of BDI-II depressive symptoms and ECR-R avoidant attachment type in close relationship were correlated with higher scores of symptom levels (fatigue, pain, and nausea or vomiting) over 14 months (see Table 3).

3.4. The psychosocial predictors of changes in breast-specific quality of life (QOL)

Table 4 indicates that after controlling the clinical and demographic data, the increases of BDI-II depressive symptoms were correlated with lower scores of body image and future perspective, but associated with higher scores of sexual enjoyment. Increasing STAI anxiety status over 14 months predicted lower scores on breast-specific QOL function, sexual enjoyment, and future perspective. Increases of ECR-R anxiety attachment style in close relationship scores were associated with lower scores of breast-specific QOL function and body image, while increased scores of ECR-R avoidant attachment style were correlated with higher sexual functioning and sexual enjoyment across the 14-month follow up.

4. Discussion

Consistent with the Western study [3], the present study on Chinese breast cancer women found that physical function and global health status persistently improve following surgery. Physical functioning in breast cancer patients undergoing oncology treatment was similar to the general population [2]. Different from previous studies on Western patients [2,3], the present study found

Table 4
The clinical and psychosocial factors predicting the changes in breast-specific quality of life over 14 months in multivariate GEE model (n = 83).

QOL dimensions	Predictors	Beta	95% CI for regression coefficients	*p*
Breast-specific Function	STAI	−1.16	−2.16~-.17	0.021
	ECR-R anxiety type	-.79	−1.36~-.23	0.006
Body image	With radiotherapy Without[0]	15.75	4.54–26.95	0.006
	With hormone therapy Without[0]	10.34	1.40–19.29	0.023
	Cancer stage IV Cancer stage 0°	−39.36	−71.20~-7.51	0.015
	Age	.84	.40–1.28	<0.001
	BDI	-.69	−1.14~-.24	0.003
	ECR-R anxiety type	-.19	-.34~-.05	0.006
Sexual functioning	Conservative surgery Modified radical mastectomy[0]	−12.13	−20.56~-3.69	0.005
	Age	.38	.05~.72	0.024
	ECR-R avoidant type	.11	.01~.23	0.036
Sexual enjoy	STAI	-.61	−1.22~-.01	0.044
	BDI	1.51	.63–2.39	0.001
	ECR-R avoidant type	.40	.04~.75	0.027
Future perspective	With chemotherapy Without[0]	−11.36	−19.31~-3.41	0.005
	Cancer stage			
	III	26.26	8.87–43.65	0.003
	II	14.72	4.58–24.86	0.004
	I	13.70	4.74–22.65	0.003
	0°			
	age	.58	.21~.95	0.002
	STAI	-.82	−1.21~-.43	<0.001
	BDI	-.82	−1.37~-.27	0.003
Breast symptoms	With chemotherapy Without[0]	28.91	6.37–51.46	0.012
	BDI	2.60	.90–4.31	0.003
Side effects	BDI	.77	.44–1.10	<0.001
	ECR-R avoidant type	.10	.01~.19	0.026
Breast symptoms Arm symptoms	BDI	.66	.29–1.03	<0.001
	With target therapy without[0]	7.79	.66–14.93	0.032
	BDI	.56	.14~.98	0.009
Hair loss	With chemotherapy Without[0]	28.70	15.17–42.23	<0.001
	Conservative surgery Modified radical mastectomy[0]	19.30	2.66–35.93	0.023

0 as reference group.
Multivariable modelling using linear generalized estimating equations (GEE) was used to identify the main predictor for breast-specific QOL. Each GEE model included the factor 'time', the demographic data (age and employed status), the clinical factors (cancer stage, types of treatments: surgery, chemotherapy, radiotherapy, target therapy, hormone therapy), the psychosocial factors (BDI-II, STAI, ECR-R anxiety and avoidant types, presence and search aspects of meaning in life).

that, the role and social functions began to recover immediately after surgery and continuing throughout the 14-month follow-up. However, similar to Western study [2], emotional function of Chinese breast cancer women did not show changes after surgery. The previous study found that emotional function of breast cancer patients undergoing oncology treatment was worse than that of the general population [2]. The averages of the duration between participating in this study at post-surgery and completing active cancer treatments (chemotherapy or/and radiotherapy) are 3.8 months. The present study identified improvements of emotional functioning at the 5th, 8th, and 14th months, suggesting that emotional functioning was unlikely to have recovered during the active cancer treatment stage. The previous follow up study found no change of emotional functioning even one year after completing treatment [3]. In the present study, compared with other functioning, it took longer until the 8th month for cognitive function to improve after surgery.

For breast-specific functions, consistent with the Western study [3], the present study on Chinese breast cancer women found that body image had not improved 14 months after surgery. Sexual functioning and enjoyment also remained no changes during 14-month follow ups. The mean scores for sexual functioning (the levels of being interested in sex and sexually active) could remain about 82–85. But as noted, less than half of breast cancer women (43/83) had resumed sexual functioning and their average scores for sexual enjoyment remained around 57 to 62. The low scores for sexual enjoyment might be influenced by breast cancer treatments. In the previous study on Western breast cancer women, the increases of sexual problems occurred immediately after breast cancer surgery and did not have better recovery at one year post-surgery than before diagnosis [34]. The sexual difficulties remained commonly in breast cancer women after completing active cancer treatments [35,36]. Young ages and psychological factors (depression, relationship with their partners) as the major predictors for sexual problems were identified in the present study and the previous studies [35,36]. Different from breast-specific functions, breast-specific symptoms (except hair loss) were significantly reduced during the 14-month follow up period.

Depressive symptoms were the major factor predicting almost all general and breast-specific function and symptoms of quality of life during the 14-month follow up time. Previous studies using a cross-sectional design also found that depression was the main psychological factor associated with breast cancer patients' quality of life during active cancer treatment, post-treatment, and long-term survivorship stages [25,26]. The present study, using a 14-month longitudinal design, identified that increased depressive symptoms persistently predicted almost all general and breast-specific functions and symptoms distress during the post-surgery stage. Moreover, the changes over 14 months in anxiety scale could predict emotional function, global health status, and breast-specific function. Higher depression and anxiety levels influence breast cancer patients to have more difficulty in coping with cancer and affecting their poorer quality of life at the disease-free survivor stage [25].

Anxiety and avoidant attachment styles were associated with poor quality of life among breast cancer women who have completed active cancer treatments within 2 years [37]. Similarly, the present study also found that increases of avoidant and anxiety

attachment types in close relationship over 14 months predicted the worse overall and breast-specific quality of life. Studies on non-cancer participants found that those with a high anxiety attachment style more likely use hyperactivating emotional coping strategies, such as tending to exaggerate negative experiences, while those with a high avoidant attachment style more likely use deactivating coping strategies such as inhibiting or suppressing distressing experiences [38,39]. Inhibiting or suppressing experiences prevents breast cancer patients from being aware of their needs [40–31] and motivation to seek support [41]. In Ho's review [20], social support could increase breast cancer patients' self-efficacy. Suppression of emotional coping, insufficient support, and lack of self-efficacy explains why an increased avoidant attachment style predicted lower emotional function and higher symptom distress levels. Breast cancer patients with an anxious attachment style more likely use hyperactivating coping, which influences them to overreact to the experiences from breast cancer. Moreover, fear of rejection and doubt about their ability to be loved, influences a breast cancer patient's view of self, close relationship, and future perspective [42]. In the present study, the search aspect of meaning in life as a protective predictor of global health status demonstrates that meaning in life as the indicator of psychological well-being for satisfaction with life among cancer patients [16,17].

In conclusion, consistent with the results of Western studies [2,3], the general quality of life among Chinese breast cancer patients persistently improves following surgery, but breast-specific functions (body image and sexual problems) did not recover one year after surgery. Depressive symptoms and insecure attachment styles were the main predictors for the general and breast-specific QOL. The future study could address the limitations of this study: measuring QOL before diagnosis of breast cancer, and including healthy control group for comparison. The psychological rehabilitation program aiming at modifying the impacts of cancer treatments, depression and insecure attachment styles on breast-specific functions, needs to be established from post-surgery and continue through the post-treatment survivorship stages.

Conflicts of interest

None.

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