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Change in quality of life in Chinese women with breast cancer: changes in psychological distress as a predictor

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Abstract *Introduction:* The effect of fluctuating psychological distress on quality of life (QoL) scores is not well delineated. We examined how changes in psychological distress affected change in QoL over time in 259 Chinese women recovering from breast cancer (BC). *Patients and methods:* Women were interviewed during their first postoperative outpatient visit for chemotherapy (Baseline), at 3 months (FU1), and at 6 months after Baseline (FU2). Respondents completed the Chinese version of the FACT-G version-3 scale [FACT-G (Ch)]. Psychological distress was assessed using three categorical measures of depression, mood, and boredom. Linear mixed effects (LME) models examined whether changes in psychological distress predicted subsequent changes in QoL. *Results:* Respondents' mood improved significantly over time from baseline to FU2 (Baseline/FU2: standardized β=−0.266, p<0.005; FU1/FU2: standardized β=−0.243, p<0.005). Changes in depression scores consistently predicted subsequent changes in overall (standardized β=4.96; 95% CI, 3.749, 6.171, p<0.001), physical (standardized β=1.752; 95% CI, 1.209, 2.294, p<0.001), and functional (standardized β=0.872; 95% CI, 0.308, 1.436, p<0.001) QoL scores. *Conclusions:* The magnitude of change in psychological distress significantly impacted physical and functional, but not social QoL in Chinese BC patients. These data highlight the need to address psychological and physical distress as part of the drive to improve physical and functional QoL for women with BC.

Keywords Breast cancer · Quality of life · Psychological distress

Introduction

The incidence of breast cancer (BC), previously low among the Chinese women, is evidencing a sharp rise. In Shanghai, China's largest city, BC incidence increased more than 50% between 1972 and 1994, to become the most prevalent female cancer [1]. In new female cancer cases, BC contributed the largest proportional increase (38.5%) between 2000 and 2005 [2]. With a 96% Cantonese-speaking Chinese population, Hong Kong has the highest BC incidence in Asia, primarily due to a cohort effect [3].

Significant psychological distress accompanies cancer diagnosis and treatment. Among Caucasians, 48% of BC patients face major depression [4–6] and 49% anxiety disorders [4, 7, 8]. Among Mainland Chinese BC patients, depression affects up to 50% [9], and among Hong Kong (HK) Chinese, 42% (95% CI, 38–44%) evidence moderate-to-severe distress 1 week and 36% (95% CI, 34–40%) 1 month after BC surgery [10]. Psychological morbidity in Caucasians declines after BC diagnosis from 33 to 24% at 3 months and 15% at 1 year [11]. Among HK Chinese women with BC, 24% (95% CI, 22–26%) remain moderately-to-severely distressed at 8 months post-surgery. Similar trajectories for psychological distress are seen for other types of cancer [12–16].

Anxiety and depression scores appear predictive of QoL functioning in long-term survivors of BC treated with mastectomy [17]. Mood disturbance influenced QoL outcome in a mixed sample of cancer patients [18]. Considering the longitudinal relationship between psychological distress and QoL, Shimozuma et al. [19] reported that BC patients with greater mood disturbance 1 month after surgery had significantly worse QoL 11 months later. Baseline "stress" predicted "psychological" QoL at baseline, at 4 months during adjuvant treatment, and at 12 months postadjuvant treatment [20].

While the above studies employed longitudinal designs, they did not evaluate the impact of changes in psychological distress on changes in QoL over time. Furthermore, the populations studied were all Caucasian. The psychological distress–QoL association awaits confirmation in other ethnic groups.

In a secondary analysis of a sample of 259 Chinese women with BC, we prospectively assessed the longitudinal course of the relationship between changes in psychological distress and QoL over time. We specifically examined (1) if there were longitudinal changes in psychological distress and QoL and (2) whether any changes in psychological distress (ΔDistress) predict subsequent changes in QoL (ΔQoL).

Materials and methods

Subjects

Participants were Chinese women with BC, newly referred to Clinical Oncology outpatient clinics at the five largest regional hospitals in Hong Kong. Inclusion criteria for patient eligibility were (1) a confirmed diagnosis of breast cancer; (2) between 18 and 85 years of age; (3) being native Cantonese speakers; (4) having no Axis I mental illnesses; (5) and having no communication problems and physical conditions that would prevent the completion of the interview. Women were selected for recruitment using a two-stage procedure. Two out of every three eligible women formed the sample frame, and from those two women, every second woman was approached and asked for informed consent.

Procedures

Procedural details have been reported [21]. Briefly, data was collected on three occasions for a large scale QoL study: (1) during the first outpatient visit to an oncology clinic for additional treatment after breast cancer surgery (baseline), (2) 3 months after baseline (first follow-up, FU1) by which time most women would be midway through any chemotherapy or radiotherapy course, and (3) 6 months after baseline (second follow-up, FU2) when most women would have completed any active treatment. Face-to-face interviews were performed by trained social workers using identical questionnaires after the patients' clinical consultation. The periodic inter-rater reliability of the questionnaire was found to be above 0.9, suggesting minimal inter-rater drift [21, 22].

Measures

Socio-demographic and medical data

Categorical socio-demographic data were collected during baseline interviews. Medical data on cancer stage, recurrence after baseline, treatment between baseline and FU1, and treatment between FU1 and FU2 were extracted from the patients' medical record using a standardized form by a medically qualified researcher.

Functional status

As previous studies showed that psychological functioning among cancer patients is often affected by functional status [23], we included three functional status variables in this study to adjust the effects of psychological distress on FACT-G (Ch) score prediction. Eating appetite was measured by an 11-point (0–10) item in the form of a statement "My eating appetite is..." At the "0" end, it was headed "very bad," whereas at the "10" end it was headed "very good." Pain was measured by an 11-point item selected from the Wisconsin Brief Pain Questionnaire (BPQ) [24], asking "How much pain do you have right now?" The "0" end headed "no pain," whereas the "10" end headed "pain as bad as you can imagine." Self-care ability was assessed in the form of a statement "the ability to take care of myself in daily life is..." and was rated on an 11-point scale. The "0" end headed "very low," whereas the "10" end headed "very high."

Quality of life (QoL)

QoL was measured with the Chinese version of the Functional Assessment of Cancer Therapy-General Scale (FACT-G) version 3 [25], which consists of 27 items scoring on 5-point scale (0="Not at all," 4="Very much"). The FACT-G (Ch) has four subscales, assessing physical well-being (Phy), social/family (Soc/Fam), emotional (Emt), and functional well-being (Fnt). Scores were added for a total score (Tot). The FACT-G (Ch) has good psychometrics and is valid for studies of adult Hong Kong Chinese cancer patients [21, 22, 26]. As the primary independent variable of this study is psychological distress, the emotional subscale of the FACT-G (Ch) was excluded to minimize collinearity.

Psychological distress

Psychological distress (distress) was operationalized with three single-item measures: one 5-point categorical measure assessing "depression" and two 10-point item assessing mood and leisure boredom (boredom). The depression item used the statement "I am depressed," rated on a 5-point scale (0=very much, 4=not at all). Mood was measured using single-item 10 cm visual analogue scale that stated "My mood is...", which was headed "very bad" "0" and "very good" "10". Satisfaction in leisure time, rather at work, is more strongly linked to QoL [27–29]. Leisure boredom acts as a buffer to health or depression under high stress conditions [30]. Leisure boredom was also measured using single-item 10 cm visual analogue scale that stated "My leisure life is...", which was headed "very boring" "0" and "very fulfilling" "10". This item was designed to assess one's perception towards leisure life, in terms of whether one finds it fulfilling or not. For all items, higher scores indicated better psychological state.

Statistical analysis

Sample descriptive analyses [mean and standard deviation (SD)] were followed by linear mixed effects (LME) analyses for all baseline socio-demographic and medical variables on QoL scores to identify potential covariates. Socio-demographic and medical variables with $p<0.10$, plus functional status were included in the final LME models as covariates. Linear associations between study variables at baseline, FU1, and FU2 were examined using the Pearson product-moment correlation coefficient [r]. Raw scores for functional status, QoL, and distress were standardized and utilized to investigate the Qol and distress trajectories using LME models. Change scores (Δ) were generated by subtracting baseline from FU1 scores and FU1 from FU2 scores. To examine whether ΔDistress was associated with ΔQoL, Model 1 to Model 4 regressed QoL scores of ΔTot, ΔPhy, ΔFnt, and ΔSoc/Fam on ΔDepression, ΔMood and ΔBoredom. If more than one psychological distress variable was significant ($p<0.05$), the model was repeated excluding nonsignificant variables and adding interaction term(s)[1] to test for the presence of interactions between psychological distress variables. Random subject effects were estimated for the intercept and slope of time (interval between interviews in months). The standardized mean scores of psychological distress and QoL were used in all LME models. The LME analyses were performed on all data collected at the three-assessment point, thus, using all information available. All models were fully adjusted for disease stage, treatment type, disease recurrence, and demographic factors where appropriate (see below). All analyses were performed using SPSS version 13.0.

Results

Sample characteristics at baseline

A total of 249 eligible BC patients were enrolled to the study at baseline. Sample attrition reduced the numbers of patients interviewed over the duration of the study. At FU1 (3 months post-recruitment), 237 of these patients, and at FU2 (6 months post-recruitment) 219 patients successfully completed assessments, yielding a follow-up rate of 88%.

Patients' socio-demographic and medical characteristics at baseline indicated that most were married (82.3%), of younger age (mean=48.37, SD=11.86), had completed primary or secondary education (76.2%), and endorsed a religion (68%) (Table 1). Among those for whom staging information was available, more than half (67%) had stage II BC. Most patients had no recurrence after baseline (93.1%) and had received treatment between baseline and FU1 (90.1%). About 75% of the FU2 sample had undergone treatment between FU1 and FU2. The results of separate LME analyses showed that age, education level, occupation, recurrence after baseline, treatment between baseline and FU1, and treatment between FU1 and FU2 predicted at least one of the QoL scores (all $p<0.05$); they were therefore included in subsequent LME model as covariates.

Correlations between QoL and psychological distress scores

Table 2 reports the cross-sectional correlations between QoL and psychological distress scores. The three psychological distress variables were moderately and significantly

[1] There were four possible interaction terms: ΔDepression×ΔMood, ΔDepression×ΔBoredom, ΔMood×ΔBoredom, and ΔDepression×ΔMood×ΔBoredom.

Table 1 Sociodemographic and medical variables at baseline (n=249)

Characteristic	Number of patients (%)
Age (years)	
Mean	48.37
SD	11.86
Marital status	
Single	15 (6.0)
Married/cohabited	205 (82.3)
Divorced/separated	12 (4.8)
Widowed	17 (6.8)
Education	
No formal education	43 (17.3)
Primary	91 (36.7)
Secondary	98 (39.5)
Tertiary	16 (6.5)
Occupation	
Full-time	82 (33.1)
Part-time	8 (3.2)
Retired/housewife	137 (55.2)
Unemployed	21 (8.5)
Family income (per month)[a]	
≤ HK$10,000	67 (26.9)
10,001–20,000	72 (28.9)
20,001–30,000	29 (11.6)
30,001–40,000	20 (8.0)
≥40,000	15 (6.0)
Do not know	43 (17.3)
No income	3 (1.2)
Endorsing a religion[b]	
Yes	104 (68.0)
No	49 (32.0)
Cancer stage at diagnosis	
0	6 (2.5)
I	34 (14.0)
II	162 (66.9)
III	33 (13.6)
IV	7 (2.9)
Cancer stage at diagnosis[c]	
Less advanced	202 (83.5)
More advanced	40 (16.5)
Recurrence after baseline[d]	
No	216 (93.1)
Yes	16 (6.9)
Treatment between baseline and FU1[e]	
No	23 (9.9)
Yes	209 (90.1)
Treatment between FU1 and FU2[f]	
No	52 (24.2)
Yes	163 (75.8)

SD Standard deviation, *FU1* follow-up 1 (conducted 3 months after baseline); FU2: follow-up 2 (conducted 6 months after baseline)
[a]US*$1=HK*$7.8
[b]The item that tapped religion was added after the start of data collection.
[c]Stage III and IV were classified as "more advanced"; other stage categories were classified as "less advanced".
[d]Recurrence after baseline indicates a recurrence documented from after baseline to 1 month after the second follow-up.
[e]Documented at the first follow-up interview.
[f]Documented at the second follow-up interview.

correlated (all p<0.01). Lower level of psychological distress was generally correlated with better QoL (all p< 0.01). Significant moderate cross-sectional correlations were found between Tot and the three psychological distress variables (all p<0.01). Of the three QoL subscores, the strength of relationship between Fnt and psychological distress was the highest, with coefficients ranging between 0.385 and 0.585 (all p<0.01). Coefficients of Soc/Fam with psychological distress were the weakest, ranging from 0.155 to 0.314 (ps<0.05).

Changes in psychological distress and QoL over time

Table 3 presents the means, standard deviations, and the results of LMS analyses. Of the eight variables examined, mood significantly improved throughout the study (baseline/FU2: β=−0.266, p<0.005; FU1/FU2: β=−0.243, p<0.005). Means of Tot (β=−0.294, p<0.005), Fnt (β=−0.365, p< 0.001), and depression (β=−0.327, p<0.001) were significantly lower at baseline as compared with means at FU2. A quadratic trend for mean Phy scores was observed; however only the baseline-FU2 comparison yielded significant differences (β=−0.170, p<0.05). No significant changes for the means of Soc/Fam and Boredom were found (ps>0.05).

Changes of psychological distress predicting changes in QoL

Models 1 to 4 regressed ΔQoL scores on ΔDistress scores (Table 4). All the three ΔDistress scores (ΔDepression: β=4.960, p<0.001; ΔMood: β=1.693, p<0.05; ΔBoredom: β=3.091, p<0.001) predicted ΔTot (Model 1). ΔDepression (β=1.752, p<0.001) and ΔMood (β=0.722, p<0.05) predicted ΔPhy (Model 2), whereas ΔDepression (β=0.872, p<0.005) and ΔBoredom (β=2.092, p<0.001) predicted ΔFnt (Model 3).

Rerunning the LME equations after excluding nonsignificant variables and adding interaction term(s) for significant predictors[2] into the models did not improve the models. We also modeled ΔDistress scores as a function of ΔSoc/Fam (Model 4); however, none of the predictors and covariates were statistically significant (p>0.05).

Discussion

Previous studies showed longitudinal associations between psychological distress and QoL [18, 19]. Our study prospectively demonstrated a positive longitudinal relationship between ΔDistress and ΔQoL over the 6-month treatment period after surgery for Chinese women with BC. Of the three distress variables assessed, ΔMood contributed least to predicting ΔQoL. ΔDepression produced the

[2] Interaction terms added in follow-up LME analyses: Model 1, ΔDepression × ΔMood × ΔBoredom; Model 2, ΔDepression × ΔMood; Model 3, ΔDepression × ΔBoredom.

Table 2 Pearson bivariate correlations between QoL and psychological distress scores[a]

	Baseline depression	Baseline mood	Baseline Tot	Baseline Phy	Baseline Fnt	Baseline Soc/Fam
Baseline depression			0.596[b]	0.368[b]	0.457[b]	0.160[a]
Baseline mood	0.581[b]		0.610[b]	0.392[b]	0.565[b]	0.211[b]
Baseline boredom	0.444[b]	0.573[b]	0.570[b]	0.425[b]	0.517[b]	0.214[b]
	FU1 Depression	FU1 Mood	FU1 Tot	FU1 Phy	FU1 Fnt	FU1 Soc/Fam
FU1 depression			0.617[b]	0.495[b]	0.385[b]	0.265[b]
FU1 mood	0.575[b]		0.657[b]	0.483[b]	0.585[b]	0.314[b]
FU1 boredom	0.418[b]	0.566[b]	0.560[b]	0.354[b]	0.575[b]	0.278[b]
	FU2 Depression	FU2 Mood	FU2 Tot	FU2 Phy	FU2 Fnt	FU2 Soc/Fam
FU2 depression			0.584[b]	0.460[b]	0.432[b]	0.155[a]
FU2 mood	0.521[b]		0.592[b]	0.387[b]	0.510[b]	0.243[b]
FU2 boredom	0.388[b]	0.539[b]	0.542[b]	0.349[b]	0.541[b]	0.260[b]

FU1 First follow-up (conducted 3 months after baseline), *FU2* second follow-up (conducted 6 months after baseline), *Tot* FACT-G (Ch) total score, *Phy* FACT-G (Ch) physical subscore, *Fnt* FACT-G (Ch) functional subscore, *Soc/Fam* FACT-G (Ch) social/family subscore
[a]Data based on cross-sectional analysis.
[b]Correlation is significant at the 0.01 level (two-tailed).
[c]Correlation is significant at the 0.05 level (two-tailed).

Table 3 Changes of quality of life and emotional states from baseline to 6 months post-diagnosis

Variable	Score range	Mean	SD	Std β	SE	*p* value	95% CI
FACT-G (Ch) Total Score	0–112						
Baseline		77.67	14.91	−0.294	0.090	< 0.005	−0.471, −0.116
FU1		79.58	14.22	−0.160	0.086	NS	−0.329, 0.009
FU2		82.23	12.55	0			
FACT-G (Ch) Physical subscale	0–28						
Baseline		23.07	4.87	0.024	0.081	NS	−0.136, 0.184
FU1		21.96	5.45	−0.170	0.084	< 0.05	−0.335, −0.005
FU2		23.20	5.08	0			
FACT-G (Ch) Functional Subscale	0–28						
Baseline		15.42	6.12	−0.365	0.092	< 0.001	−0.546, −0.184
FU1		17.04	5.55	−0.066	0.085	NS	−0.233, 0.101
FU2		17.69	5.16	0			
FACT-G (Ch) Social/Family Subscale	0–28						
Baseline		20.48	4.97	−0.141	0.099	NS	−0.335, 0.054
FU1		21.10	4.28	0.022	0.088	NS	−0.151, 0.194
FU2		20.95	3.86	0			
Depression	0–4						
Baseline		2.94	1.27	−0.327	0.091	<0.001	−0.507, −0.148
FU1		3.13	1.15	−0.156	0.084	NS	−0.322, 0.009
FU2		3.36	0.94	0			
Mood	0–10						
Baseline		6.64	2.23	−0.266	0.086	< 0.005	−0.434, −0.098
FU1		6.68	2.12	−0.243	0.082	< 0.005	−0.403, −0.083
FU2		7.23	1.72	0			
Boredom	0–10						
Baseline		6.00	2.36	−0.153	0.089	NS	−0.328, 0.021
FU1		6.02	2.33	−0.143	0.087	NS	−0.314, 0.028
FU2		6.47	2.61	0			

For all variables, the higher the score the better.
Score range maximum range of possible scores, *FU1* first follow-up (conducted 3 months after baseline), *FU2* second follow-up (conducted 6 months after baseline), *FACT-G (Ch)* Functional Assessment of Cancer Therapy General Measure (Chinese version), *SD* standard deviation, *Std β* standardized beta coefficient, *SE* standard error, *CI* confidence interval, *NS* not significant *p* value at 0.05 level.

Table 4 Linear mixed effects models for the association between changes in psychological distress and changes in QoL

Model[a]	Std β	SE	95% CI	*p* value
Model 1: Dependant, ΔFACT-G (Ch) total score				
Δ Depression	4.960	0.616	3.749, 6.171	< 0.001
Δ Mood	1.693	0.667	0.382, 3.005	< 0.05
Δ Boredom	3.091	0.647	1.820, 4.363	< 0.001
Model 2: Dependant, ΔFACT-G (Ch) physical subscale				
Δ Depression	1.752	0.276	1.209, 2.294	< 0.001
Δ Mood	0.722	0.294	0.145, 1.300	< 0.05
Model 3: Dependant, ΔFACT-G (Ch) functional subscale				
Δ Depression	0.872	0.287	0.308, 1.436	< 0.005
Δ Boredom	2.092	0.291	1.521, 2.663	< 0.001
Model 4[b]: Dependant, ΔFACT-G (Ch) social/family subscale				
Intercept	−0.260	0.476	−1.196, 0.676	NS

FACT-G (Ch) Functional Assessment of Cancer Therapy General Measure (Chinese version), *depression* scored on a scale of 0–4, *mood and boredom* scored on a scale of 0–10, *Std β* standardized beta coefficient, *SE* standard error, *CI* Confidence interval, *Δ* change scores generated by subtracting the baseline scores from the FU1 scores and the FU1 scores from the FU2 scores, *NS* not significant *p* value at 0.05 level

[a]Covariates include age, education level, occupation, treatment (baseline/FU1), and treatment (FU1/FU2), eating appetite, pain, and self-care ability.

[b]No significant change scores in psychological distress were found.

highest standardized beta coefficient at 4.96 (Model 1), indicating that each unit ΔDepression predicted a corresponding 4.96-unit change in QoL. ΔDepression consistently predicted ΔTot, ΔPhy, and ΔFnt QoL, contributing an average of 2.53-point change in QoL per unit ΔDepression. These data imply that significant interactions exist between depression and QoL.

Results of the LME models showed a significant linear and improving trend in mood over time, consistent with previous studies of different types of cancer patients [12–15]. In contrast with Andrykowski et al.'s [31] report that both hospital discharge and 100 days after surgery were "transition points" where patients with bone marrow transplantation regain better QoL, the present data revealed that the significant improvement of total well-being, functional well-being, and depression mainly occurred from referral to 6 months post-diagnosis (Table 2). As other studies of BC have found, the first 6 months postsurgery is when most psychological adjustment occurs in Chinese women. Lam et al. have shown that recovery in Chinese women continues for at least 8 months after surgery [10].

ΔBoredom predicted changes in overall QoL (β=3.091, p<0.001, Model 1) and functional QoL (β=0.872, p< 0.005, Model 3) better than did ΔDepression. These findings are in line with the construct of depression that loss of interest in leisure activities is an important indicator of depression. ΔDistress was not a significant predictor of the social and family aspects of QoL. This implies that distress is linked more closely to symptom- or treatment-related factors or loss of ability than to social and family relationship. Because single item measures tend to be affected by a wider range of factors, contamination by other influences, for example, physical symptoms including fatigue cannot be ruled out.

There are several limitations to this study. First, most patients (83.5%) had early-stage BC which has a good prognosis. Therefore, the current findings may not generalize to patients with advanced BC or with a recurrence. Second, the use of single items to assess distress limits confidence in our results. Single-item measures offer simplicity and enhance response rates among sick patients, but they lack robustness and can have poor validity. However, previous research showed that single-item measure of depression ("Do you often feel sad or depressed?") accurately classified more than 80% of elderly patients [32] or patients with stroke [33], and both sets of findings were confirmed using standardized depression scales. For logistical reasons, we were unable to use standardized scales to tap psychological distress, which is assumed to be multidimensional. The possibility that distress impacts on QoL because that is one dimension of what QoL scales are supposed to measure, and hence, the results reflect the sensitivity of QoL measures is not arguable as we excluded the emotional subscale to avoid this possibility. If the other QoL subscales are sensitive to distress, then either the instrument is open to contamination, has poor specificity, or distress affects subsequent QoL evaluation or reporting by patients. Third, as the findings obtained in this study were specifically derived from Chinese women with BC, these results may not generalize to other oncology populations and ethnic groups. As such, replication of the present findings in other samples is needed. Finally, the current study primarily focused on whether the extent of change in psychological distress was associated with change in QoL scores. Future investigations should consider patterns of change at the individual level to explore whether direction

of change varied across patients and whether such differences impact change in QoL scores.

As QoL measures become more widespread in oncology and cancer care, clinicians need to consider that factors other than physical symptoms might influence physical and functional QoL. Reported pain level, for example, is significantly influenced by psychological state [34] and depressed mood influences recall content [35]. Distress seems to also have a bearing on QoL, which we have shown fluctuates as a function of distress. Preventing or minimizing distress should therefore have an enhancing effect on overall QoL in women with early stage BC and be an effective strategy to help improve outcome indicators.

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