

Multiple predictors of health-related quality of life in early stage breast cancer. Data from a year follow-up study compared with the general population

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Abstract

Prospective longitudinal health-related quality of life (QOL) data from 161 women newly diagnosed with breast cancer were compared to age-adjusted mean QOL scores from a general female population ($n = 949$). In addition, multiple factors (demographic, personality trait, participation in treatment decision-making, information satisfaction, and medical data), which previous research has indicated affect the QOL of breast cancer patients, were simultaneously investigated in a multivariate model, *in order to determine which of these variables have the strongest influence on QOL one year after surgery*. QOL was evaluated with the EORTC QLQ-C30 at time of diagnosis, three- and 12-months postoperatively. Women with breast cancer scored significantly lower on emotional, cognitive, and social functioning ($p < 0.01$) at time of diagnosis compared to the general female population, and continued to score lower on cognitive ($p = 0.008$) and social ($p = 0.009$) functioning one-year after surgery. In addition to the initial QOL, breast conservation surgery was predictive of better physical functioning ($p = 0.01$) and body image ($p < 0.0001$), while chemotherapy was predictive for poorer role functioning ($p = 0.01$) *one year after surgery*. Dispositional optimism was predictive for better emotional ($p = 0.003$) and social functioning ($p = 0.01$) *one year after surgery*. At time of diagnosis and throughout the post-diagnosis period, dispositional optimism was associated with better QOL and fewer symptoms.

Key words: Breast cancer surgery, Dispositional optimism–pessimism, Quality of life

Introduction

Over the past 10 years there has been considerable research on the quality of life (QOL) of women who have survived breast cancer. More recently research has focused on variables that may explain why some women are more vulnerable to experiencing poorer QOL than other women. One vital issue is whether a woman's QOL is associated with her personality. According to Scheier and colleagues [1] personality trait optimism–pessimism affects psychological well-being by influencing how individuals approach and react to critical life situations.

Much of the literature on the effects of optimism–pessimism deals with emotional well-being and has demonstrated that optimism has beneficial

effect on people's emotional well-being, health and life satisfaction (review, [1]). QOL is a multi-level and amorphous concept. In relation to health, QOL is defined as a multidimensional concept that consists of at least physical, psychological, role and social functioning [2]. However, only a few studies have investigated the role of optimism–pessimism in maintenance of functional health status. One recent study by Carver and colleagues [3] on breast cancer patients found that pessimism was associated with disruption of social and recreational activities. Allison and colleagues' [4] study on head and neck patients found that optimists reported better role, cognitive and emotional functioning than pessimists. Brenes and colleagues [5] found that pessimism was associated with poorer physical functioning among adults with

knee pain. Maruta and colleagues' [6] study of optimism–pessimism assessed in the 1960s and self-reported health status 30 years later, pessimism was associated with poorer physical and mental functioning. Also, in a normative aging study, optimism was found to be associated with better mental functioning [7]. The question therefore arises whether pessimism is predictive for poorer global-health QOL and the functioning dimensions of QOL of women diagnosed and treated for breast cancer.

Studies investigating predictors of breast cancer survivors QOL have focused on demographic and clinical factors. Younger age, lower level of education and greater severity of the disease, axillary dissection, adjuvant therapy and living alone were found to be associated with poorer QOL [8–15]. Poor doctor–patient communication has also been associated with poorer health outcome [16]. Viewpoints regarding the impact of breast conserving surgery (BCS) vs. mastectomy (MAS) on QOL are divergent. Some studies emphasize that BCS helps to maintain body image [17–19], while others fail to demonstrate a difference in QOL [20, 21]. Patient involvement in treatment decision-making is another factor that seems to improve patients' QOL [22–24]. Furthermore, giving women a choice between BCS and MAS seems to reduce distress [25, 26] and might therefore affect their QOL. Despite the vast literature on QOL and breast cancer patients, no analysis simultaneously including all these factors has been reported, it is still unclear what factors have the most effect on the health-related QOL of breast cancer patients. Furthermore, few studies have investigated predictors of health-related QOL after breast cancer surgery in the context of a comparison between breast cancer survivors and non-disease comparison group. Predictors of health-related QOL in breast cancer patients are important in planning efficacious services.

Reviewing the literature on breast cancer patients' health-related QOL, no prospective longitudinal studies were found that compared health-related QOL of women diagnosed with breast cancer before and during treatment with data from the general female population. These comparisons are needed to evaluate the appropriateness of present services and make adjustments according to patient needs throughout the trajectory of the disease.

A few studies have compared health-related QOL of breast cancer survivors with a general female population, but the findings are divergent. There were no difference between breast cancer survivors and healthy women overall health-related QOL, although breast cancer survivors reported more physical symptoms than healthy women [27–29], breast cancer survivors rated their role and social functioning higher than the general population [9], breast cancer survivors report more fatigue than healthy controls [30, 31], breast cancer survivors were more functionally impaired than healthy controls [32]. Clearly, further research is required to determine the impact of a breast cancer diagnose before, during and after treatment.

The present study had two aims. First to compare health-related QOL of women diagnosed with breast cancer with the general female population at time of diagnosis, three- and 12-months after surgery. Second to assess multiple predictors of breast cancer patients' health-related QOL and to investigate their impact on health-related QOL in a multivariate model.

Methodology

Study samples and recruitment

Women were recruited after their initial visit at the outpatient department where they received their diagnosis. Women were eligible for participation if they met the following criteria: newly diagnosed with operable breast cancer, no other major disabling medical or psychiatric conditions that would confound evaluation of health-related QOL (henceforth referred to as QOL), ability to read and write Norwegian, aged 18 years or older. The study was explained to potential subjects ($n = 245$) who were provided with a stamped return-envelope containing letter of explanation, informed consent form and questionnaires, to be returned before surgery. Thus, they had no definite knowledge about future treatment plans, or stage of disease. The time between diagnosis and surgery varied from 2 to 21 days. The average length of time between diagnosis and completion of the baseline questionnaires was 12 days. A total of 195 patients consented to participate and completed the questionnaires at time of diagnosis, yielding a

response rate of 80%. New questionnaires were mailed three- and 12-months after surgery. Seven women had advanced cancer (clinical classification cT3/T4) and were therefore excluded. Analyses were conducted only on data of participants who completed the questionnaires at all assessments ($n = 161$). No statistically significant differences were found in demographics, medical variables, dispositional optimism/pessimism or QOL at time of diagnosis, between participants ($n = 161$) and dropouts ($n = 27$).

The general population sample, henceforth referred to as controls, was drawn from data used in Hjermstad and colleagues' study of health-related QOL in the General Norwegian Population, assessed by the European Organization for Research and Treatment of Cancer Core Quality of Life questionnaire (EORTC QLQ-C30) [33]. Originally, the population sample ($n = 3000$) was supplied by The Office of the National Register, based on a random sample of all adult Norwegians. The response rate for women was 69%, and only the female sample data ($n = 949$) were used in the present study.

The Norwegian Regional Ethics Committee approval was obtained before the start of the study.

Variable measures

Demographic and medical data.

Information on demographic data such as; age, marital status, educational background, and employment status was obtained by self-report at time of diagnosis. Medical data such as; type of surgery, lymph node dissection, lymph node involvement, cancer stage and adjuvant therapy (radiotherapy, chemotherapy, tamoxifen or combinations) were collected from the patients medical journal after surgery.

Treatment decision-making participation.

A five-item scale from a questionnaire developed and validated for a former study [34] was used to assess participation in treatment decision-making. The items assessed satisfaction with the information received (one-item), if patients received a choice between BCS and MAS (one-item), if patients wanted to participate (one-item) and participated in treatment decision-making (two-items), utilized a 4-point scale, from 1 (not at

all) to 4 (very much). The reliability coefficient for the 5-item scale was 0.76. Patients completed the questionnaire within two weeks after surgery.

The EORTC QLQ-C30 was used to measure health-related QOL. This 30-items self-rating questionnaire has been developed and validated internationally by the EORTC Study Group on QOL [35]. It is linearly transformed from 2, 4 or 7-point scales to a 0–100-point scale. Scales were calculated as mean scores of items that comprise the scale. Missing values were replaced according to the manual [36]. The questionnaire is composed of scales that evaluate five functioning dimensions: physical, role, emotional, cognitive and social, as well as global-health status QOL. Higher mean scores represent better functioning and QOL. Three symptom scales measure nausea/vomiting, pain and fatigue. Six single items assess financial impact and physical symptoms of dyspnoea, insomnia, appetite, diarrhoea and constipation. Higher mean values represent more symptoms. The reliability coefficients for the multi-items scales ranged from 0.54 to 0.86 before treatment and 0.60 to 0.91 after treatment. The time frame used is the past week.

Sexual functioning and body image are not included in the EORTC QLQ-C30 questionnaire. A difference between the groups (MAS vs. BCS) in this respect would be missed. Therefore, with the authors' permission, we included the questionnaire used in the European study "Caring about women and cancer (CAWAC)" [37] to assess body image and sexual functioning. The Norwegian version was translated and validated by a national expert panel [38]. The body image scale has five items, utilizing a 5-point scale, from 0 (total disagreement) to 4 (total agreement) and the reliability of scale was $\alpha = 0.85$. To assess sexual functioning, women were asked if the effect of illness/treatment had a negative impact on their sexual life (yes/no). If they answered yes they were asked if this was due to physical, emotional discomfort or both. The time frame was one year after surgery.

The *Life Orientation Test-Revised* (LOT-R) (40) was used to assess the personality trait of dispositional optimism/pessimism. The LOT-R is a 10-item (6 target items and 4 fillers) self-report scale, measuring expectations experienced at this point in time about positive outcome in general, using a 5-point scale, from 0 (strongly disagree) to

4 (strongly agree). An average score was derived from the six target items. Higher scores are indicative of greater optimism, and lower scores of lower optimism, referred to as pessimism [39]. Scores ranged from 0 to 24. In the present study, $\alpha = 0.74$. The time frame used is now.

Statistical analysis

The Statistical Package for Social Sciences (SPSS) was used for statistical analysis. The significance level was set at 5%. Chi-square test were used to compare categorical variables; *t*-tests were used to compare means of continuous variables for two groups and *change over time*; one-way analysis of variance was used to compare means of continuous variables for three or more groups. Spearman's correlation coefficient was used to analyze associations between two continuous variables. The controls QOL mean scores were adjusted to match the age distribution in the cancer sample. This was done by obtaining expected QOL mean scores by using the controls reference values [33] and calculating the expected scores that would be observed for subjects of the same age distribution as the patients [40] (see Appendix 1). To adjust for differences in age when comparing patients QOL mean scores with controls, linear regression analysis was used. Cohen's *d* [41] was used to calculate effect size. Multiple regression analysis was used to investigate predictors of functioning, global-health QOL and *body image scales for one year following breast cancer surgery*.

Results

Participant characteristics

The mean age for patients was 56 years, (range 21–78). Diagnoses included invasive ductal carcinoma (85%), invasive lobular carcinoma (9%), ductal carcinoma *in situ* (2%), mucinous carcinoma (1%), and tubular carcinoma (3%). All patients had early stage breast cancer. No significant differences were found comparing patients with cTis, cT1 and cT2 in regard to demographic data, and type of surgery. Eighty-six percent underwent lymph node dissection and 28% had positive lymph node status. Sixty percent received a choice between BCS and MAS, 68% participated in

treatment decision-making, and 88% were satisfied with the information received. Descriptive data on patients are summarized in Table 1. Controls and patients were similar with respect to marital status and educational level, but differed in mean age ($49 \pm \text{SD } 19$ years, vs. 56 ± 10 years).

Patient's QOL compared to the general population

At baseline, patients experienced significantly more anxiety, depression, worries, irritations (emotional functioning, $d = 0.69$) and more difficulty in concentrating and remembering (cognitive functioning, $d = 0.32$), than controls (Table 2). In addition, they perceived that their physical condition interfered with their family life and social activities (social functioning, $d = 0.40$). Also they

Table 1. Descriptive data for breast cancer patients (n = 161)

Demographics	
Age (years)	
Mean \pm SD	56 \pm 10.3
Range	21–78
Marital status (%)	
Married/cohabitant	62
Divorced	16
Single	11
Widow	11
Have children (%yes)	85
Employment (%)	
Full time	37
Part time	14
Full time housewife	3
Retired	23
Disabled	21
Under education	2
Education > 12 years (%)	42
Family history of breast cancer (%)	23
Medical data	
Breast cancer stage (%)	
T1	68
T2	30
Tis	2
Histological grade (%)	
I	27
II	55
III	18
Lymph node positive (%)	28
Type of surgery (%)	
BCS	59
MAS	41
Treatment	
Systematic adjuvant treatment (%)	38
Radiotherapy only (%)	43
Surgery only (%)	19

Table 2. Patients mean (\pm SD) QOL scores at time of diagnosis, three- and 12-months after surgery compared to mean QOL scores from a general Norwegian female population

	General female population N = 949	Women at time of diagnosis N = 161	<i>p</i> -Value	3-month after surgery	<i>p</i> -Value	12-months after surgery	<i>p</i> -Value
Global health/QOL*	72.0 \pm 24.5	70.3 \pm 22.8	0.48	74.3 \pm 21.7	0.38	75.7 \pm 21.4	0.28
<i>Functioning scales*</i>							
Physical	83.4 \pm 18.0	87.1 \pm 18.1	0.24	81.2 \pm 19.9	0.22	84.9 \pm 19.3	0.45
Role	78.6 \pm 27.6	76.7 \pm 27.7	0.09	73.0 \pm 27.5	0.004	77.4 \pm 27.1	0.19
Emotional	80.2 \pm 21.8	66.0 \pm 22.4	<0.0001	76.4 \pm 22.5	0.009	78.0 \pm 21.7	0.06
Cognitive	86.8 \pm 19.2	80.2 \pm 21.9	0.004	81.4 \pm 18.9	0.008	82.0 \pm 18.3	0.008
Social	84.6 \pm 22.4	74.7 \pm 27.6	0.001	77.3 \pm 25.3	0.007	80.0 \pm 23.4	0.009
<i>Symptom scales/items**</i>							
Fatigue	31.9 \pm 25.6	30.1 \pm 21.8	0.06	35.3 \pm 24.4	0.24	28.2 \pm 22.3	0.004
Nausea/vomiting	4.5 \pm 12.2	4.9 \pm 10.2	0.75	7.4 \pm 15.0	0.11	4.1 \pm 13.6	0.43
Pain	27.9 \pm 28.7	18.2 \pm 23.4	0.001	20.6 \pm 24.7	0.01	18.6 \pm 26.7	0.001
Dyspnoea	15.6 \pm 23.4	13.9 \pm 20.8	0.15	12 \pm 15.9	0.11	18.4 \pm 25.3	0.44
Insomnia	28.2 \pm 31.6	38.2 \pm 31.9	<0.0001	34.6 \pm 33.9	0.02	31.4 \pm 32.4	0.15
Appetite loss	6.7 \pm 20.8	16.5 \pm 26.5	<0.0001	12.5 \pm 25.1	0.02	9.3 \pm 19.4	0.91
Constipation	15.2 \pm 25.6	11.5 \pm 24.0	0.14	13.7 \pm 25.3	0.23	11.4 \pm 24.4	0.04
Diarrhoea	10.1 \pm 21.2	15.2 \pm 25.0	0.004	17.3 \pm 26.7	<0.0001	13.6 \pm 22.4	0.04
Financial difficulties	12.3 \pm 25.9	6.5 \pm 19.7	0.04	11.0 \pm 23.2	0.82	11.0 \pm 21.3	0.81

*Higher score indicates better functioning.

** Higher score indicates more symptoms.

The general female population means scores in the table are the age-adjusted mean scores.

p-values are from age-adjusted linear regression analyses.

reported significantly more insomnia ($d = 0.32$), appetite loss ($d = 0.42$) and diarrhoea ($d = 0.22$) than controls (Table 2).

Three months after surgery although patients reported significant improvement in emotional functioning ($p < 0.0001$, $d = 46$), they continued experience significantly poorer emotional ($d = 0.17$) than the controls. In contrast cognitive and social functioning did not improve significantly and patients continued to experience significantly poorer cognitive ($d = 0.28$) and social functioning ($d = 0.31$) than controls. In addition they also experienced limitation in doing their work or daily activities and pursuing their hobbies or other leisure time activities (role functioning, $d = 0.20$). They also continued to report more insomnia ($d = 0.20$), appetite loss ($d = 0.25$) and diarrhoea ($d = 0.30$) than controls. In addition patients experienced more fatigue three months after surgery than at time of diagnosis ($p = 0.02$, $d = 0.23$), but no more than the controls (Table 2).

Patients reported significant improvement between three and one year in role functioning ($p = 0.01$, $d = 0.16$). One year after surgery patient's global-health QOL ($p = 0.03$, $d = 0.24$)

and emotional functioning ($p < 0.0001$, $d = 0.55$) improved significantly compared to their initial scores. No significant difference was found between the remaining initial and 12-months functioning scores. Patients continued to score significantly lower than the controls on cognitive ($d = 0.26$) and social functioning ($d = 0.20$) (Table 2). Between three and 12-months patients symptoms declined to such a degree that patients reported similar or fewer symptoms than controls (Table 2). Comparing patient's initial symptoms scores with their 12-months scores, only their appetite improved significantly ($p = 0.007$; $d = 0.31$). In addition, patients experienced more financial difficulties one year after surgery than at time of diagnosis ($p = 0.03$; $d = 0.23$), but no more than the controls.

Predictors for QOL, body image and sexual functioning one year after surgery

Univariate analyses

The global-health QOL (GHQOL) scale correlated substantially with all functioning scales ($r = 0.20$ – 0.60 ; $p < 0.01$) at each assessment point (Table 3).

Table 3. Correlation between global-health quality of life, functioning and dispositional optimism at time of breast cancer diagnosis and one year after surgery

	LOT-R ¹	One year following breast cancer surgery						
		LOT-R ²	GHQOL	PF	EF	RF	CF	SF
LOT-R ²			0.43**	0.21	0.55**	0.26**	0.23**	0.30**
<i>At time of diagnosis</i>								
LOT-R ¹		0.71**	0.29**	0.12	0.42**	0.20**	0.20**	0.29**
Global health QOL	0.36**	0.36**	0.51**	0.27**	0.40**	0.42**	0.27**	0.38**
<i>Functioning QOL</i>								
Physical	0.14	0.15	0.38**	0.59**	0.32**	0.37**	0.21**	0.26**
Emotional	0.47**	0.46**	0.42**	0.11	0.55**	0.25**	0.28**	0.34**
Role	0.28**	0.29**	0.34**	0.29**	0.36**	0.40**	0.30**	0.34**
Cognitive	0.33**	0.28**	0.39**	0.17	0.33**	0.34**	0.49**	0.40**
Social	0.30**	0.28**	0.42**	0.25**	0.35**	0.36**	0.22**	0.54**

LOT-R¹ is dispositional optimism measure at time of diagnosis.

LOT-R² is dispositional optimism measured at one year.

**Correlation is significant at the 0.01 level (2-tailed).

Demographic data

None of the variables were associated with GHQOL or body image. Older age was significantly correlated with better social functioning ($r = 0.18-0.25$; $p < 0.04$) and poorer physical functioning ($r = -0.25$ to -0.27 ; $p = 0.001$) at all assessments. In addition older age was also significantly correlated with better role ($r = 0.16$, $p = 0.04$) and emotional functioning ($r = 0.17$; $p = 0.03$). Higher level of education (more than 12 years) was associated with better emotional functioning at baseline ($p = 0.05$) and one year ($p = 0.009$), but not at three months. Family history of breast cancer was associated with better emotional functioning at baseline ($p = 0.02$) and one year after surgery ($p = 0.03$), but not at three months. Marital and employment status were not associated with global health QOL or functioning.

Medical data

Lowest cancer stage (cT1/Tis) was significantly associated with better GHQOL and role functioning at three- and 12-months ($p = 0.04$) and body image at 12-months ($p = 0.03$). Positive lymph nodes were associated with poorer emotional functioning at three months ($p = 0.03$). BCS was associated with better body image at 12-months ($p \leq 0.0001$) (Figure 1). BCS was also significantly associated with better physical functioning at three months (BCS 86.1 vs. MAS 74.9, $p < 0.0001$) and one year (BCS 89.8 vs. MAS 78.8, $p < 0.0001$). In addition BCS was significantly associated with better physical functioning at one year (BCS 82.5 vs. MAS 70.6, $p = 0.005$). Chemotherapy was associated with poorer social functioning ($p = 0.04$) and more nausea/vomiting ($p < 0.0001$) at three months and poorer role

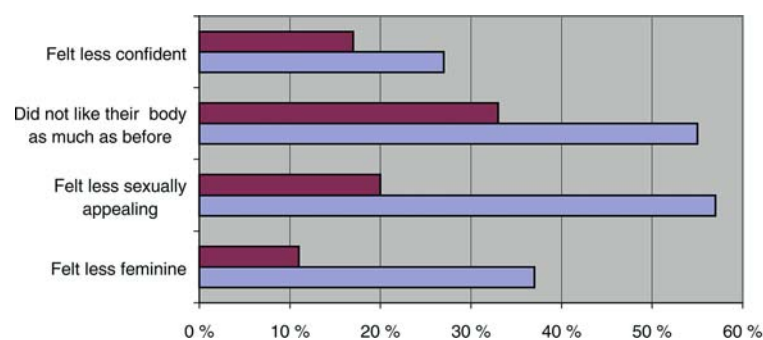


Figure 1. Body image after breast conservative surgery (BCS) and mastectomy (MAS) at 12-months.

functioning ($p = 0.01$) at one year. Hormonal and/or radiotherapy were not associated with GHQOL or functioning or symptom scales at three- or 12-months. Twenty-eight percent of the patients reported that their illness/treatment had negative impact on their sexual life. Chemotherapy ($p < 0.0001$), higher cancer stage ($p = 0.02$) and younger age ($p = 0.008$) were associated with poorer sexual functioning at one year.

Choice and decision-making

Receiving a choice between BCS and MAS was significantly associated with better physical, cognitive and social functioning at three months ($p < 0.05$) and physical and role functioning at 12 months ($p < 0.05$). Satisfaction with information was associated with better emotional ($p = 0.02$) and social functioning ($p = 0.04$) at baseline, and better cognitive functioning ($p = 0.009$) and less fatigue ($p = 0.02$) and nausea/vomiting ($p = 0.02$) at three months.

Personality (optimism/pessimism)

Optimism was significantly correlated with better GHQOL, and better functioning (except physical functioning) ($r = 0.21$ – 0.47 ; $p < 0.01$) at all assessments (Table 3). Optimism was significantly correlated with better body image at three and 12-months ($r = 0.21$ – 0.39 ; $p \leq 0.01$).

Multiple regression analysis was conducted including all variables that were significantly

associated at the 0.05 level in the univariate analyses with the dependent variable GHQOL at one year. *GHQOL and functioning scores at three months were not included.* In this model, only baseline GHQOL was predictive of GHQOL after one year and accounted for 29% of the variance (Table 4). Similar analyses were performed separately for each functioning domain *at one year.* In all regression models, when baseline functioning was included, it was the strongest predictive variable for one year functioning, accounting for 20–34% of the variance the functioning domains of QOL at one year (Table 4). BCS was predictive for better physical functioning and body image at one year ($p \leq 0.01$) (Table 4, Figure 1). Chemotherapy was predictive for poorer role ($p = 0.01$) and sexual functioning ($p < 0.0001$). Optimism was predictive for better emotional, social functioning and body image ($p \leq 0.01$) (Table 4).

Discussion

Our data suggest that receiving a breast cancer diagnosis has an impact on patient's emotional, cognitive and social functioning, and that cognitive and social functioning have the slowest recovery. In contrast, general health/ QOL and particularly physical functioning were stable throughout the post-diagnosis period and similar to the general population. Furthermore, at diagnosis and three

Table 4. Predictors for the different quality of life domains and body image at 12 months

Dependent variables	Predictor variables	Model-adjusted R^2 (p -Value)*	Coefficient β	Standard error	p -Value**
Global-health QOL	Initial global-health QOL	29 (<0.0001)	0.52	0.06	<0.0001
Physical Functioning (PF)	Initial PF	0.37 (<0.0001)	0.56	0.07	<0.0001
	Type of surgery		0.16	2.5	0.01
Role Functioning (RF)	Initial RF	0.22 (<0.0001)	0.41	0.08	<0.0001
	Chemotherapy		0.19	5.4	0.01
Emotional Functioning (EF)	Initial EF	0.34 (<0.0001)	0.45	0.07	<0.0001
	Dispositional optimism		0.22	0.36	0.003
Cognitive Functioning (CF)	Initial CF	0.28 (<0.0001)	0.52	0.06	<0.0001
	Age		-0.18	0.12	0.009
Social Functioning (SF)	Initial SF	0.30 (<0.0001)	0.49	0.06	<0.0001
	Dispositional optimism		0.16	0.37	0.01
Body image	Type of surgery	0.24 (<0.0001)	-0.35	4.1	<0.0001
	Dispositional optimism		0.34	0.41	<0.0001

* p -value from F -test for significant overall regression.

** p -value from t -test of individual parameter estimates.

Coding for Breast conserving surgery (BCS) = 2, Mastectomy (MAS) = 1.

months patients reported significantly more insomnia, appetite loss and diarrhoea than the general population. However, the symptoms declined between three- and 12-months, to such a degree that patients reported similar or fewer symptoms than the general population at 12-months. Previous studies assessing the quality of life of breast cancer patient within the first year after surgery also found that most symptoms declined between three- and 12-months [10, 42]. Our findings that patient reported poorer social and cognitive functioning after breast cancer treatment differ with results from previous studies that found no difference between breast cancer survivors (4–5 years survivors) and healthy women's overall QOL [9, 27–29], except for one. Chirikos and colleagues [32] found in their retrospective study that breast cancer survivors, 10-years after their treatment reported poorer physical, role, emotional and social functioning compared to cancer-free controls.

Three recent studies without control groups [13, 14, 43] also found that breast cancer survivors (4–5 years survivors) reported poor social functioning. Cimbrich and colleagues [13] found that lower age (<44 years) was associated with poorer social functioning, while Keer and colleagues [43] found that poorer social functioning was associated with being unsatisfied with information received. Ganz and colleagues [14] found that poorer social functioning was associated with having received systemic adjuvant therapy. Although we did find that poorer social functioning was associated with chemotherapy at three months and younger age at three- and 12-months in the univariate analysis, our evaluation of predictors for social functioning at 12-months after surgery revealed that poorer social functioning was significantly associated with initial social functioning and pessimism. Also Carver and colleagues [3] found that pessimism was predictive for poorer social functioning. It seems that when confronted by medical threats, pessimism leads to a higher degree of withdrawal from the normal social activities. This disruption in social life appears to be related to the higher level of emotional distress experienced by pessimistic women [3].

Previous studies have found that breast cancer patients who had received chemotherapy reported having trouble with memory and concentration

(review, [44]). In contrast no association was found between chemotherapy and cognitive functioning in the present study. Difficulty in concentration and memory may be associated with depressive symptoms or intrusive thoughts regarding cancer [45]. However, this was not explored in the present study. Further research is needed to understand the causal mechanisms of cognitive complaints among breast cancer survivors. Chemotherapy in the present study was found to be predictive for poorer role functioning one year after surgery. This is in consistent with two recent studies. Ganz and colleagues [14] found in their five-year follow-up study of breast cancer survivors that past chemotherapy was associated with poorer current role functioning. King and colleagues [10] found that chemotherapy was associated with poorer role functioning at 12-months. Taken together these findings suggest that there may be late health-related QOL effects from chemotherapy affecting role functioning. Post-chemotherapy rheumatism has been found to affect functional status [46]. However, the relationship between the women's ability to perform their work or daily activities at 12-months or more and having received chemotherapy is not immediately clear and warrants further investigation.

Interpreting results from QOL assessments is somewhat problematic. So far, no general agreement exists of the definition of clinical significance [33, 47]. Using a approach as suggested by Cella [48], an effect size of 0.26 or 0.20, as found for the difference in cognitive and social functioning, between the general female population and breast cancer population, would be considered of no clinical value or according to Cohen [40]) as a relatively small difference. Another approach is to define a change of 10 units on a 0–100 scale as clinically significant [33, 47]. The difference of 5 units found in the present study between the patients and general populations cognitive and social functioning would not be considered to be clinically significant. However, clinical significance is subjective, and a matter of opinion. Therefore, in view of previous findings that breast cancer patients have reported cognitive impairment and social disruption [3, 14, 43, 44] our findings appear to have clinical relevance. Taken together these findings should encourage clinicians to assess if women experience concentration and memory

problems, and if the treatment or their physical condition interferes with their family life or social activities.

Our examination of the predictors of 12-months QOL after breast cancer surgery found that pessimism, in addition to predicting poorer social functioning, also predicted emotional functioning regardless of demographic or medical variables. Thus adding to the small but growing body of research demonstrating that the personality trait optimism–pessimism influences some of the functioning dimensions of QOL [3–7]. Our findings suggest that women at risk for poorer emotional and social functioning at 12-months following breast cancer surgery can be identified at time of diagnosis. Knowledge about a patient's pessimistic disposition at time of diagnosis would allow clinicians to adjust the intensity of follow-up management and/or provide them with clinical interventions to enhance emotional and social functioning.

The only other medical variable found in the present study to be predictive for a functioning dimension of QOL type of surgery. MAS, in addition to initial physical functioning was predictive of poorer physical functioning after one year, indicating that more radical surgery influences the performance of strenuous activities, (e.g. carrying heavy shopping bag) or daily activities (e.g. dressing, washing, eating). Most MAS patients also had axillary dissection, which increases the risk of arm problems [10]. Furthermore, a recent study by Engel and colleagues [49] demonstrated the consistency and strength of arm dysfunction on breast cancer patients' on several functioning quality of life dimensions over five years including physical functioning. Therefore, poorer physical functioning may be due to arm problems. However, we cannot conclude this to be the reason since patients were not asked if they experienced arm problems after surgery. MAS was also found to be predictive for poorer body image, thus supporting the view that BCS helps maintain patients' body image [11, 12, 17]. Like our study, two other studies found no age differences in body image [50, 51]. Thus, it appears that even women over 70 years may benefit from BCS. Therefore, physicians should not underestimate the importance of appearance to older patients and whenever possible encourage the choice of BCS.

One should note that regardless of surgery type, 28% of the patients reported that their illness/treatment had negative impact on their sexual life. Chemotherapy has been shown to affect sexual functioning [29, 52], particularly relevant to younger women. Also in the present study, poorer sexual functioning was associated with chemotherapy and younger age. Younger women were more likely candidates for aggressive chemotherapy that could have made them prematurely menopausal, thus contributing to sexual dysfunction. Clinicians can use this data to guide their follow-up care. Women may be reluctant to ask questions about intimate functioning themselves. It is therefore incumbent upon the clinician to raise the subject. In addition, since women in our study reported that poorer satisfaction with sexual life was due to emotional as well as physical discomfort, some type of sexual counselling may be helpful.

This is one of the first reports to compare women's QOL at the time of breast cancer diagnosis with the QOL of the general female population, in addition to examining comprehensively preoperative predictors of future QOL in breast cancer patients. The response rate for the Norwegian female population and patients were high, 69 and 80% respectively. All patient in the present study had early stage breast cancer. Therefore, further research, which substantiates or refutes our findings in an advanced breast cancer population, is needed. A potential limitation of our study is the large number of tests of significance, which increases the risk for Type I error. Therefore, only significant findings ($p \leq 0.01$) have been discussed. In conclusion, our data provides much needed knowledge for planning and providing services for breast cancer patients throughout the trajectory of the disease.

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Appendix 1

Reference values for the EORTC QLQ-C30 global health quality of life, functioning and symptom/items scales from the

general Norwegian female population were obtained (with the authors permission) from the study of health-related QOL in the General Norwegian Population conducted by Hjermsstad and colleagues [33].

Reference values for the global health QOL, broken down by age

Age group (years)	General female population
18–29	77.9
30–39	75.7
40–49	72.7
50–59	74.1
60–69	70.2
≥70	67.6
Total	949

Age distribution of the breast cancer patients – number of subjects in each category who completed the global health QOL scale

Age group (years)	Breast cancer patient
18–29	1
30–39	4
40–49	33
50–59	57
60–69	50
≥70	16
Total	161

From the reference values, the “expected” mean score for the female aged 18–29 years is 77.9 [33]. Therefore, for 161 females with the same age distribution as the breast cancer patients, we would expect a total sum score of:

$$1 \times 77.9 + 4 \times 75.7 + 33 \times 72.7 + 57 \times 74.1 + 50 \times 70.2 + 16 \times 67.6 = 11595.1.$$

Therefore, the expected mean sum score for the females is $11595.1/161 = 72.01$.

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