



Life Quality Index Assessment in Breast Cancer Patients

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Abstract

Breast cancer (BC) is the most common cancer in Indian females whether they are from urban or rural area. Quality of life after treatment in BC patients is a very vital issue as its assessment will guide the clinicians, hospital authorities, and administrators to take appropriate steps to improve the delivery of treatment and address the concern. Improvement in QOL should be one of the ultimate aims of treatment in BC. The aim of this review is to collect and examine literature available on QOL in breast cancer patients and define what type of issues or domains should be studied. Four factors including chemotherapy treatment received by the patient, associated comorbidities, social support to patients from family, friends, support groups, and income of family have been found to have a strong association with QOL in BC patients/survivors. QOL assessment should include an instrument which assesses physical health, social health, psychological health, and spiritual health. There are less studies having all above domains so more studies are required for better understanding of QOL issue in BC patients/survivors.

Keywords Breast cancer · Quality of life · Survivor · Physical health · Survivorship

Introduction

Breast cancer (BC) is the most common cancer in Indian females [1] whether they are from urban or rural area. The incidence has risen due to early detection, betterment of health facilities, diagnostic facilities, and increasing awareness of health and cancers. Quality of life (QOL) after treatment in BC patients is a very vital issue as its assessment will guide the clinicians, hospital authorities, and administrators to take appropriate steps to improve the delivery of treatment and address the concern. Improvement in QOL should be one of the ultimate aims of treatment in BC. QOL issue assessment is important in BC patients for several reasons. First, as it is the commonest cancer, the number of women with BC and survivors is increasing. Secondly, survival of BC has

improved in last two decades because of early detection, better treatment facilities, availability of more BC experts, and new systemic therapies. Thirdly, BC in a female causes suffering of the whole family as she has a role of wife, mother, and homemaker. It seems that all family members who are intimately related suffer. Diagnosis of BC and long treatment has shown to have positive and negative effects in recovery and QOL as different interventions have different effects. BC patients are at risk of developing physical problems (fatigue, sleep disturbances, pain), psychological problems (depression, anxiety, negative thoughts, fear of cancer recurrence, fear of death, sense of aloneness, sexual and body image problems), and disease-specific problems. Ferrans et al. defined QOL as “a person’s sense of well-being that stems from satisfaction or dissatisfaction with the areas of life that are important to him or her.” [2] QOL concept includes not only a patient’s physical health but it also includes his or her perceptions and expectations above their health. Expectations about health vary with age of patient having breast cancer. Overall, the QOL includes the four domains: physical, psychological, social (includes sexual), and spiritual well-being and a balance of all four domains will determine the individual’s QOL. The aim of this review is to collect and examine literature available on QOL in breast cancer patients and define what type of issues or domains should be studied.

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Table 1 Details of instruments that are commonly used to assess quality of life in breast cancer patients

Type of assessment	Description of measure with abbreviations used
General	Short Form Health Survey (SF-36) Spitzer Quality of life Index (QLI) Sickness impact profile (SIP) Ferrans and Powers Quality of Life Index (QLI)
Breast cancer specific	European Organizations for Research and Treatment of cancer Core Quality of Life Questionnaire (EORTC QLQ-C30) Functional Assessment of Chronic illness Therapy-Breast (FCIT-B) Functional Living Index—Cancer (FCIT-B) Breast Cancer Chemotherapy Questionnaire (BCQ) The satisfaction with life domains scale for breast cancer (SLDS-BC)
Psychological	General Health Questionnaire-28 (GHQ-28) Hospital anxiety and depression scale (HADS) Beck depression inventory (BDI) Center for Epidemiologic studies depression scale (CES-D) State trait anxiety inventory (STAI) Profile mood state (PMS) Mental adjustment to cancer scale (MACS) Psychosocial adjustment to illness scale (PAIS)
Other	Functional assessment of chronic illness therapy-spiritual (FACIT-SP) Body image scale (BIS) Body image after Breast Cancer questionnaire (BIBCQ) Watts Sexual Functioning Questionnaire (WSFQ) Social Support Questionnaire (SSQ) Life Satisfaction Questionnaire (LSQ) Satisfaction with Life Scale (SWLS)

Material and Methods

We searched the MEDLINE data by key words “Breast Cancer” and “Survivors”, “Quality of Life”, Health related Quality of Life”, “QOL”, and “Well-being after treatment” from a reference list. Other cross reference articles were reviewed. Articles only in English language were included.

Results

There are several instruments used for QOL in BC patients and these can be grouped into general, BC specific, psychological, symptoms and other which are summarized in Table 1. Moore et al. and Priestman et al. published initial two papers on QOL in BC in 1974 and

Table 2 Initial validation studies of QOL instruments in breast cancer patients

Authors	Instrument used	Emphasis on
Levine et al., 1988 [5]	Breast Cancer Chemotherapy Questionnaire (BCQ)	Questionnaire-based outcome measure
Ciampi et al., 1988, [6]	Linear Analog Self-assessment scale	Analysis of physical, emotional, social health issues
Carlsson and Hamrin, 1996, [7]	Life Satisfaction Questionnaire (LSQ-32)	Analysis of six factors: quality of family relation, physical symptoms, socioeconomic situation, quality of daily activities, sickness impact, quality of close friend relation.
Sprangers et al., 1996, [8]	European Organizations for Research and Treatment of cancer Breast Cancer specific Quality of Life questionnaire (EORTC QLQ-BR23)	Analysis of symptoms and side effects related to different treatment modalities, body image, sexuality and future perspective.
Brady et al., 1997, [9]	The functional assessment of cancer therapy Breast Cancer specific questionnaire (FACT-B)	Analysis of patients values and brevity
Fallowfield et al. 1999, [10]	An endocrine symptom subscale for the FACT-B (FACT-B plus ES)	QOL in women undergoing hormonal therapy for breast cancer
Coster et al., 2001, [11]	Functional Assessment of Cancer therapy (FACT-B)	Analysis of arm morbidity after surgery
Carpenter, 2001, [12]	Assessment of sleep quality index (PSQI), fatigue (PMOS-SF), depression symptoms (CE-SD)	Sleep quality
Parmar et al., 2005, [13]	The EORTC QLQ-C30	QOL in breast cancer patients
Avis and Foley, 2006, [14]	The Quality of Life in Adult Cancer Survivors (QLACS)	Health-related quality of life in long-term survivors.

Table 3 Studies published in QOL after surgery or systemic treatment

Authors	Time of assessment	Conclusion
Ganz et al., 1992, [15]	Mastectomy vs conservative surgery	No better quality of life or mood in conservative surgery More intensive psychological intervention is required in the postoperative period in breast conservative surgery.
Shimozuma et al., 1995, [16]	Impact of breast conservation treatment and mastectomy on the QOL in early stage breast cancer patients	BCT does not always improve the patients QOL BCT requires more psychological support.
Curran et al., 1998 [17]	QOL of early-stage breast cancer patients with radical mastectomy or breast-conserving procedures	Breast conservation maintained the patient's body image Higher satisfaction with treatment in breast conservation group No significant fear of recurrence in both groups.
Shimozuma et al., 1999, [18]	Mastectomy versus breast conservation surgery	After 1 year of good QOL regardless the type of surgery.
Kenny et al., 2000, [19]	Early stage breast cancer treatment by mastectomy or conservative surgery	Good quality of life after 1 year treatment In BCT group—better body image but worse physical function BCT more expensive
Janni et al., 2001, [20]	Mastectomy or Breast Conservation Surgery	Surgical treatment had no long-term effect on overall QOL.
Engel et al., 2004, [21]	Mastectomy or breast conservation surgery after 5-year follow-up	Better QOL with breast-conserving treatment
Barranger et al., 2005, [22]	Sentinel lymph node biopsy (SLNB) axillary lymph node dissection (ALND) in breast sparing treatment	Significantly lower midterm morbidity in SLNB
Pandey et al., 2006, [23]	Mastectomy or breast conservation surgery	No significant change in overall QOL before and after surgery QOL was better in patients who underwent breast conservation than mastectomy.
Keiery et al., 1990, [24]	In early-stage breast cancer peri-operative chemotherapy versus no chemotherapy	No difference
Osoba and Burchmore, 1999, [25]	Trastuzumab in metastatic breast cancer	Better QOL when treated with combination of trastuzumab and chemotherapy rather than chemotherapy alone
Osoba et al., 2002, [26]	In metastatic breast cancer impact of chemotherapy with trastuzumab versus chemotherapy alone.	Better QOL with chemotherapy with trastuzumab
Borromely et al., 2004, [27]	Patients with metastatic breast cancer receiving combination therapy (doxorubicin with paclitaxel AT)	No such difference in QOL was found in both the groups
Martin et al., 2006, [28]	Patients treated with FAC FU	Health-related QOL of breast cancer patients with TAC was found worse than treated with FAC
Fallowfield et al., 2006, [29]	Patients treated with tamoxifen	No effect of QOL
Cella et al., 2006, [30]	Adjuvant treatment of operable breast cancer patients	Anastrozole and tamoxifen have similar effects on health-related QOL
Karamouzis et al., 2007, [31]	Patients with metastatic breast cancer under chemotherapy	QOL of breast cancer patients was better receiving chemotherapy than only supportive care.

1976 respectively. After the 1990s, there was gradual rise in publications in this area with papers describing to measure QOL in BC survivors. Levine et al. in 1988 published a paper based on questionnaire Breast Cancer chemotherapy Questionnaire (BCQ). This paper is considered as one of the initial validation study in this field [3–5]. Table 2 summarizes studies which used newer instruments and their validation. Treatment in BC patients is usually a combination of surgery (mastectomy or breast conservation), irradiation, and systemic therapy (chemotherapy, hormone targeted). Various studies have tried to study QOL after surgery or in patients receiving systemic

treatment [5–14]. Table 3 summarizes studies published in QOL after surgery or systemic treatment [15–31]. There are studies which have tried to correlate QOL with survival. Some studies concluded that QOL does not affect survival [32, 33]. Studies by Coats et al. [34], Livrme et al. [35], and Efficace et al. [36] found physical health, pain, and appetite as significant prognostic factors for survival in advanced BC. BC patients and survivors both can develop psychological distress (depression, anxiety, and emotional instability). This has been extensively studied and it definitely contributes to QOL. These patients have various concerns right from the time of diagnosis,

Table 4 Description of quality of life instruments (disease specific) in long-term breast cancer survivors

Instruments	Domains (Items)	Domain description	Ferrel's QoL domains			
			Ph.	Ps.	So.	Sp.
Disease-specific measurers			Ph.	Ps.	So.	Sp.
Body image and relationship scale (BIRS) [37]	3 (32)	Strength and health, social barriers, appearances, and sexuality	√	√	√	–
Cancer Rehabilitation Evaluation System Cancer-Short Form (CARES-SF) [38]	6 (59)	Global CARES-SF; physical; psychosocial; medical interaction; marital relationship; sexual concerns	√	√	√	–
European Organization for Research and Treatment of Cancer (EORTC QLQ-C30) [39]	10 (30)	Functional domains: physical; role; emotional; cognitive; social; global QoL Symptom domains: fatigue; nausea/vomiting; pain Single-item domain: dyspnea, appetite loss, sleep disturbance, constipation, diarrhea	√	√	√	–
European Organization for Research and Treatment of Cancer-Breast Module (EORTC QLQ-BR23) [40]	8 (23)	Body image; sexual functioning; arm symptoms; breast symptoms; sexual enjoyment; systemic therapy side-effects; future perspective; upset by hair loss	√	–	–	–
Ferrans and Powers's Quality of Life Index-Cancer Version (QLI-CV) [41]	2 (70)	Satisfaction with various domains of life (part 1): health and functioning; socioeconomic; psychological/spiritual; family importance of the same domains to the subject (part 2): health and functioning; socioeconomic; psychological/spiritual; family	√	√	√	√
Functional Assessment of Cancer Therapy-Breast (FACT-B) [8]	7 (44)	Emotional well-being; functional well-being; physical well-being; social/family well-being; relationship with doctor; breast cancer subscale; additional concerns	√	√	√	–
Functional Assessment of Cancer Therapy-General (FACT-G) [42]	5 (28)	Emotional well-being; functional well-being; physical well-being; social/family well-being; relationship with doctor	√	√	√	–
Functional Assessment of Chronic Illness Therapy-Spiritual Well Being Scale (FACIT-SP) [9]	2 (12)	Faith; purpose	–	–	–	√
Quality of life-Cancer Survivor (QOL-CS) [43]	4 (41)	Physical well-being; psychological well-being; social well-being; spiritual well-being	√	√	√	√
Quality of Life in Adult Cancer Survivors Scale (QLACS) [44]	12 (47)	Generic domains: physical pain; negative feelings; positive feelings; cognitive problems; sexual problems; social avoidance; fatigue Cancer-specific domains: distress about family; distress about recurrence; appearance concerns; benefits of cancer; financial problems resulting from cancer	√	√	√	√

Ph. physical, Ps. psychological, So. social, Sp. spiritual

treatment schedules, and after completion of treatment. The concerns are fear of recurrence, fear of death,

Table 5 Description of quality of life instruments (BC specific) in long term breast cancer survivors

Instruments	Domains (items)	Domain description	Ferrel's QoL domains
BC-specific measures			
Fatigue Symptom Inventory (FSI) [45]	3 (13)	Intensity of fatigue; interference of fatigue; fatigue duration	√ – – –
Multidimensional Fatigue Symptom Inventory (MFSI) [14]	5 (83)	Global fatigue; somatic symptoms; affective symptoms; behavioral symptoms; cognitive symptoms	√ – – –

Ph. physical, Ps. psychological, So. social, Sp. spiritual

continuous feelings of change in body image, and change in femininity and sexuality. QOL assessment should include not only physical health and treatment factors but it should also include social, economic, psychological, spiritual, and family domains. Dr. Casol Estwing Ferrans, a researcher of medical surgical department at college of nursing, University of Illinois, Chicago, developed a Quality of Life Index known as “Ferrans and Powers Quality of Life index” which include all above domains. It has 33 items in total. There are various studies on QOL issues in BC which have studied above domains. Table 4 summarizes the various studies which have included one or more domains (physical, psychological, social, and spiritual health) [8, 9, 37–44]. Table 5 summarizes BC-specific instruments like FSI and MFSI [14, 45]. Table 6 summarizes QOL studies in long-term BC survivors in which all four Ferrans Quality of life domains were evaluated. Instruments QOL-CS, FACT-G, QLI-CV, FSI, and FACIT-ST include all four domains for evaluation in BC patients and survivors [46–50].

Table 6 Quality of Life studies in long-term breast cancer survivors in which all four Ferrell's Quality of Life domains like physical, psychological, social, and spiritual were evaluated

Study	Objectives of the study	Instruments used/administration	Results
Dow et al. (1997) [46]	Comparison of mood and QOL of BCS with those observed in low-risk breast cancer screening patients	QOL-Cs, FACT-G Self-administered	Concerns included psychological/family distress, fear of recurrence, uncertainty, fatigue, chest pain, sleep problems and sexuality.
Sammarco et al. al (2003) [47]	Evaluation of relation among social support, uncertainty, and QOL in older breast cancer survivors (BCS)	QLI-CV; other instruments (SSQ, MUIS-C). Self-administered	There was significant association between perceived social support and QOL. Uncertainty resulted in poorer QOL.
Perkins et al. (2007) [48]	Evaluation of individual differences in well-being in older BCS.	FACIT-SP, FSI; other instruments (SF-36, LOT-R). Self-administered	Higher age predicted increased depression. Poorer health status was associated with poorer well-being.
Leak et al. (2008) [49]	Examining relation among symptom distress, spirituality, and QOL of African-American BCS	QLI-CV; other instruments (SDS, SPS). Interviewer-administered	Sleep disturbance, fatigue, and pain were the most commonly reported symptoms in African-American BCS.
Sammarco et al. (2008) [50]	Examining relation among perceived social support and uncertainty on Hispanic BCS's QOL.	QLI-CV; other instruments (SSQ, MUIS-C). Self-administered	Perceived social support and uncertainty play a pivotal role in managing or maintaining QOL in Hispanic BCS

There are only BC condition-specific instruments (FSI and MFSI) which are validated in breast conservation patients and both measure fatigue [14, 45]. In terms of administration, most of the instruments such as EORTC QLQC30, EORTC QLQ-BR23, FACIT-SP, QOL-CS, QLI-CV, and MFSI could be self-administered or administered by an interviewer. The administration time for some instruments, such as EORTC QLQ-C30, FACT-G, FACT-B, and MFSI is from 5 to 15 min for interview as reported by the author.

Conclusion

In BC, QOL has been extensively studied in patients and long-term survivors. The various factors which were considered important and were studied are chemotherapy received, associated medical condition, social support available, income of the family, employment status, ethnicity, anxiety, health perceptions, life stress, belief that the world is controllable, age at diagnosis, marital status, time since diagnosis, and stage of disease. Only four factors including chemotherapy treatment received by the patient-associated comorbidities, social support to patients from family, friends, support groups, and income of family have been found to have a strong association with QOL in BC patients/survivors. Many studies concluded that long-term BC survivors have overall good QOL and it becomes better with increasing number of year of survival [51].

In summary, QOL assessment should include an instrument which assesses physical health, social health, psychological health, and spiritual health. There are less studies having

all above domains so more studies are required for better understanding of QOL issue in BC patients/survivors.

References

1. Stewart BW, Paul Kleihues P (2003) World cancer report. Lyon, France, international agency research on cancer
2. Ferrans CE (1990) Development of a quality of life index for patients with cancer. *Oncol Nurs Forum* 17(3 Suppl):15–19 discussion 20–21
3. Moore FD, van de Vanter SB, Boyden CM, Lokich J, Wilson RE (1974) Adrenalectomy with chemotherapy in the treatment of advanced breast cancer: objective and subjective response rates, duration and quality of life. *Surgery* 76:376–390
4. Priestman TJ, Baum M (1976) Evaluation of quality of life in patients receiving treatment for advanced breast cancer. *Lancet* 1:899–900
5. Levine MN, Guyatt GH, Gent M, De Pauw S, Goodyear MD, Hryniuk WM, Arnold A, Findlay B, Skillings JR, Bramwell VH et al (1988) Quality of life in stage II breast cancer: an instrument for clinical trials. *J Clin Oncol* 6:1798–1810
6. Ciampi A, Lockwood G, Sutherland HJ, Llewellyn-Thomas HA (1988) Assessment of health related quality of life: factor scales for patients with breast cancer. *J Psychosocial Oncol* 6:1–19
7. Carlsson M, Hamrin E (1996) Measurement of quality of life in women with breast cancer. Development of a life satisfaction questionnaire (LSQ-32) and a comparison with the EORTC-C30. *Qual Life Res* 5:265–274
8. Sprangers MAG, Groenvold M, Arraras JI, Franklin J, teVelde A, Muller M, Franzini L, Williams A, de Haes HC, Hopwood P, Cull A, Aaronson NK (1996) The European Organization for Research and Treatment of Cancer breast cancer-specific quality-of-life questionnaire module: first results from a three-country field study. *J Clin Oncol* 14:2756–2768

9. Brady MJ, Cella DF, Mo F, Bonomi AE, Tulsy DS, Lloyd SR, Deasy S, Cobleigh M, Shiimoto G (1997) Reliability and validity of the functional assessment of cancer therapy breast quality of life instrument. *J Clin Oncol* 15:974–986
10. Followfield LJ, Leaty SK, Howell A, Benson S, Cella D (1999) Assessment of quality of life in women undergoing hormonal therapy for breast cancer: validation of an endocrine symptom subscale for the FACT-B. *Breast Cancer Res Treat* 55:189–199
11. Coster S, Poole K, Fallowfield LJ (2001) The validation of a quality of life scale to assess the impact of arm morbidity in breast cancer patients post-operatively. *Breast Cancer Res Treat* 68:273–282
12. Carpenter JS (2001) The hot flash related daily interference scale: a tool for assessing the impact of hot flashes on quality of life following breast cancer. *J Pain Symptom Manag* 22:979–989
13. Parmar V, Badwe RA, Hawaldar R, Rayabhattanavar S, Varghese A, Sharma R, Mitra I (2005) Validation of EORTC quality-of-life questionnaire in Indian women with operable breast cancer. *Natl Med J India* 18:172–177
14. Avis NE, Foley KL (2006) Evaluation of the Quality of Life in Adult Cancer Survivors (QLACS) scale for long-term cancer survivors in a sample of breast cancer survivors. *Health Qual Life Outcomes* 4:92–102
15. Ganz PA, Schag CA, Lee JJ, Polinsky ML, Tan S (1992) Breast conservation versus mastectomy: is there a difference in psychological adjustment or quality of life in the year after surgery. *Cancer* 69:1729–1738
16. Shimozuma K, Sonoo H, Ichihara K, Miyake K, Kurebayashi J, Ota K, Kiyono T (1995) The impact of breast conserving treatment and mastectomy on the quality of life in early-stage breast cancer patients. *Breast Cancer* 2:35–43
17. Curran D, van Dongen JP, Aaronson NK, Kiebert G, Fentiman IS, Mignolet F, Bartelink H (1998) Quality of life of early-stage breast cancer patients treated with radical mastectomy or breast conserving procedures: results of EORTC trial 10801. *Eur J Cancer* 34:307–314
18. Shimozuma K, Ganz PA, Petersen L, Hirji K (1999) Quality of life in the first year after breast cancer surgery: rehabilitation needs and patterns of recovery. *Breast Cancer Res Treat* 56:45–57
19. Kenny P, King MT, Sheill A, Seymour J, Hall J, Langlands A, Boyages J (2000) Early stage breast cancer, costs and quality of life one year after treatment by mastectomy or conservative surgery and radiation therapy. *Breast* 9:37–44
20. Janni W, Rjosk D, Dimpfl T, Haertl K, Strobl B, Hepp F, Hanke A, Bergauer F, Sommer H (2001) Quality of life influenced by primary surgical treatment for stage I-III breast cancer-long term followup of a matched-pair analysis. *Ann Surg Oncol* 8:542–548
21. Engel J, Kerr J, Schlesinger-Raab A, Sauer H, Halzel D (2004) Quality of life following breast-conserving therapy or mastectomy: results of a 5-year prospective study. *Breast J* 10:223–231
22. Barranger E, Dubernard G, Fleurence J, Antoine M, Darai E, Uzan S (2005) Subjective morbidity and quality of life after sentinel node biopsy and axillary lymph node dissection for breast cancer. *J Surg Oncol* 92:17–22
23. Pandey M, Thomas BC, Ramdas K, Ratheesan K (2006) Early effect of surgery on quality of life in women with operable breast cancer. *Jap J Clin Oncol* 36:468–472
24. Kiebert GM, Hanneke J, de Haes CJ, Kievit J, van de Velde CJ (1990) Effect of peri-operative chemotherapy on the quality of life of patients with early breast cancer. *Eur J Cancer* 26:1038–1042
25. Osoba D, Burchmore M (1999) Health-related quality of life in women with metastatic breast cancer treated with trastuzumab (Herceptin). *Semin Oncol* 26(4 Suppl 12):84–88
26. Osoba D, Slamon DJ, Burchmore M, Murphy M (2002) Effects on quality of life of combined trastuzumab and chemotherapy in women with metastatic breast cancer. *J Clin Oncol* 20:3106–3113
27. Bottomley A, Biganzoli L, Cufer T, Coleman RE, Coens C, Efficace F, Calvert HA, Gamucci T, Twelves C, Fargeot P, Piccart M (2004) Randomized controlled trial investigating short-term health-related quality of life with doxorubicin and paclitaxel versus doxorubicin and cyclophosphamide as first-line chemotherapy in patients with metastatic breast cancer: European Organization for Research and Treatment of Cancer Breast Cancer Group, Investigational Drug Branch for Breast Cancer and the new drug development group study. *J Clin Oncol* 22(13):2576–2586
28. Martin M, Lluch A, Segui MA, Ruzi A, Ramos M, adrover E, Rodriguez-Lescure A, Grosse R, Calvo L, Fernandez-Chacon C, Roset M, Anton A, Isla D, del Prado PM, Iglesias L, Zaluski J, Arcusa A, Lopez-Vega JM, Munoz M, Mel JR (2006) Toxicity and health-related quality of life in breast patients receiving adjuvant docetaxel, doxorubicin, cyclophosphamide (TAC) or 5-fluorouracil, doxorubicin and cyclophosphamide (FAC): impact of adding primary prophylactic granulocyte-colony stimulating factor to the TAC regimen. *Ann Oncol* 17:1205–1212
29. Fallowfield LJ, Bliss JM, Porter LS, Price MH, Snowdon CF, Jones SE, Coobes RC, Hall E (2006) Quality of life in the intergroup exemestane study: a randomized trial of exemestane versus continued tamoxifen after 2 to 3 years of tamoxifen in postmenopausal women with primary breast cancer. *J Clin Oncol* 24:910–917
30. Cella D, Fallowfield L, Barker P, Cuzick J, Locker G, Howell A (2006) Quality of life of postmenopausal women in the ATAC (Arimidex, tamoxifen, alone or in combination) trial after completion of 5 years' adjuvant treatment for early breast cancer. *Breast Cancer Res Treat* 100:273–284
31. Karamouzis MV, Ioannidis G, Rigatos G (2007) Quality of life in metastatic breast cancer patients under chemotherapy or supportive care: a single-institution comparative study. *Eur J Cancer Care* 16:433–438
32. Goodwin PJ, Ennis M, Bordeleau LJ, Pritchard KT, Trudeau ME, Koo J, Hood N (2004) Health-related quality of life and psychosocial status in breast cancer prognosis: analysis of multiple variables. *J Clin Oncol* 22:4184–4192
33. Efficace F, Therasse P, Piccart MJ, Coens C, van Steen K, Welnicka-Jaskiewicz M, Cufer T, Dyczka J, Lichinitser M, Shepherd L, de HH, Srangens MA, Bottomley A (2004) Health-related quality of life parameters as prognostic factors in a nonmetastatic breast cancer population: an international multicenter study. *J Clin Oncol* 22:3381–3388
34. Coates A, Gebski V, Signorini D, Murray P, McNeil D, Byne M, Forbes JF (1992) Prognostic value of quality of life scores during chemotherapy for advanced breast cancer. Australian New Zealand Breast Cancer Trial Group. *J Clin Oncol* 10:1833–1838
35. Luoma ML, Hakamies-Blomqvist L, Sjostrom J, Pluzanska A, Ottoson S, Mouridsen H, Bengtsson NO, Bergh J, Malmstrom P, Valvere V, Tennvall L, Blomqvist C (2003) Prognostic value of quality of life scores for time to progression (TTP) and overall survival time (OS) in advanced breast cancer. *Eur J Cancer* 39:1370–1376
36. Efficace F, Biganzoli L, Piccart M, Coens C, van Steen K, Cufer T, Coleman RE, Calvert HA, Gamucci T, Twelves C, Fargeot P, Bottomley A (2004) Baseline health-related quality of life data as prognostic factors in a phase III multicenter study of women with metastatic breast cancer. *Eur J Cancer* 40:1021–1030
37. Hormes JM, Lytle LA, Gross CR, Ahmed RL, Troxel AB, Schmitz KH (2008) The body image and relationships scale: development and validation of a measure of body image in female breast cancer survivors. *J Clin Oncol* 26:1269–1274
38. Schag CAC, Ganz PA, Heinrich RL (1991) Cancer rehabilitation evaluation system—short form (CARES-SF). *Cancer* 68:1406–1413

39. McLachlan SA, Devins GM, Goodwin PJ (1998) Validation of the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (QLQ-C30) as a measure of psychosocial function in breast cancer patients. *Eur J Cancer* 34:510–517
40. Niezgodna HE, Pater JL (1993) A validation study of the domains of the core EORTC quality of life questionnaire. *Qual Life Res* 2:319–325
41. Osoba D, Zee B, Pater J, Warr D, Kaizer L, Latreille J (1994) Psychometric properties and responsiveness of the EORTC quality of Life Questionnaire (QLQ-C30) in patients with breast, ovarian and lung cancer. *Qual Life Res* 3:353–364
42. Ferrans CE (1990) Development of a quality of life index for patients with cancer. *Oncol Nurs Forum* 17:15–19
43. Cella DF, Tulsky DS, Gray G, Sarafian B, Linn E, Bonomi A, Silberman M, Yellen SB, Winicour P, Brannon J, Eckberg K, Lloyd S, Purl S, Blendowski C, Goodman M, Barnicle M, Stewart I, McHale M, Bonomi P, Kaplan E, Taylor S IV, Thomas CR Jr, Harris J (1993) The functional assessment of cancer therapy scale: development and validation of the general measure. *J Clin Oncol* 11:570–579
44. Peterman AH, Fitchett G, Brady MJ, Hernandez L, Cella D (2002) Measuring spiritual well-being in people with cancer: the functional assessment of chronic illness therapy-spiritual well-being scale (FACIT-Sp). *Ann Behav Med* 24:49–58
45. Ferrell BR, Dow KH, Grant M (1995) Measurement of the quality of life in cancer survivors. *Qual Life Res* 4:523–531
46. Dow KH, Ferrell BR, Leigh S, Ly J, Gulasekaram P (1996) An evaluation of the quality of life among long-term survivors of breast cancer. *Breast Cancer Res Treat* 39:261–273
47. Sammarco A (2003) Quality of life among older survivors of breast cancer. *Cancer Nurs* 26:431–438
48. Perkins EA, Small BJ, Balducci L, Extermann M, Robb C, Haley WE (2007) Individual differences in well-being in older breast cancer survivors. *Crit Rev Oncol Hematol* 62:74–83
49. Leak A, Hu J, King CR (2008) Symptom distress, spirituality, and quality of life in African American breast cancer survivors. *Cancer Nurs* 31:E15–E21
50. Sammarco A, Konecny LM (2008) Quality of life, social support, and uncertainty among Latina breast cancer survivors. *Oncol Nurs Forum* 35:844–849
51. Cimprich B, Ronis DL, Martinez-Ramos G (2002) Age at diagnosis and quality of life in breast cancer survivors. *Cancer Pract* 10:85–93

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