

Quality of Life as a Predictor of Weight Loss in Obese, Early-Stage Breast Cancer Survivors

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Purpose/Objectives: To investigate whether quality of life (QOL) assessed before weight loss intervention predicts weight loss and, in turn, what the effect of weight loss is on QOL measures after 12 months in early-stage breast cancer survivors.

Design: A clinical trial of a weight loss intervention in breast cancer survivors.

Setting: Communitywide recruitment in Detroit, MI.

Sample: 39 breast cancer survivors (body mass index = 30–44 kg/m²), within three years of initial diagnosis and at least three months after chemotherapy or radiation therapy.

Methods: Participants were randomized to one of three weight loss methods or a control group. The Functional Assessment of Cancer Therapy–Anemia (FACT-An) QOL questionnaire was administered at baseline and after the intervention.

Main Research Variables: Six subscales of the FACT-An and weight change.

Findings: Modest but statistically significant associations were found for the physical and functional subscales of the FACT-An with weight loss for 39 subjects who completed 12 months of the study. Those reporting relatively impaired physical or functional QOL at baseline lost more weight, which accounted for 8%–9% of the weight loss variance beyond that resulting from the diet arm assignment. At 12 months, greater weight loss was associated with significant improvements in overall FACT-An score and in the physical, functional, fatigue, and anemia subscales ($p < 0.05$).

Conclusions: Relatively low physical function at baseline was not a barrier to weight loss; indeed, it may have been a motivating factor in adherence to the weight loss intervention. Weight loss was associated with improvement in several QOL subscale measures in breast cancer survivors, but the emotional and social subscales were not affected.

Implications for Nursing: Counseling for weight loss that includes recommendations for exercise should not be withheld for patients with relatively low physical functioning.

Key Points . . .

- The quality of life in obese breast cancer survivors after 12 months in a weight loss study was influenced by baseline quality of life and the percentage of weight change.
- The physical and functional quality-of-life domains, anemia, fatigue, and overall quality of life were significantly improved by weight loss.
- Subjects with low baseline physical and functional quality of life lost more weight than subjects with higher baseline scores.
- Physical and functional concerns should not deter recommendations for weight loss through exercise and diet.

Strawbridge, & Kaplan, 2003). Many studies suggest that QOL diminishes as the degree of obesity increases (Kolotkin et al., 2001; McInnes & Knopf, 2001).

Obesity and Breast Cancer

Obesity in cancer survivors may be especially worrisome. The diagnosis of cancer alone adversely affects health, and cancer survivors bear a disproportionate burden of illness and lost productivity that extends many years after diagnosis (Yabroff, Lawrence, Clauser, Davis, & Brown, 2004). Unfortunately, preexisting obesity and overweight in patients with breast cancer may be exacerbated by further weight gain or increases in body fat during and after treatment (Demark-Wahnefried et

Weight gain leading to overweight and obesity is becoming a worldwide epidemic that has increased dramatically in prevalence during recent years (National Center for Health Statistics, 2002). As a result, major adverse implications exist for health, both in the physical and mental domains (National Heart, Lung, and Blood Institute Obesity Education Initiative, 1998; Pi-Sunyer, 2002). For example, decreased quality of life (QOL) and increased rates of depression and psychological distress have been found to be associated with obesity (Fine et al., 1999; Fontaine, Redden, Wang, Westfall, & Allison, 2003; Kolotkin, Meter, & Williams, 2001; Marchesini et al., 2003; Roberts, Deleger,

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al., 2001; Freedman et al., 2004; Goodwin et al., 1998; Rock & Demark-Wahnefried, 2002).

In addition to the effects of obesity on health, obesity can affect the course of the disease process in patients with breast cancer. Recurrence rates and survival in early-stage disease have been negatively affected by increased body weight in most studies (Chlebowski, Aiello, & McTiernan, 2002; Enger, Greif, Polikoff, & Press, 2004; Kroenke, Chen, Rosner, & Holmes, 2005; Maru, van der Schouw, Gimbrere, Grobbee, & Peeters, 2004; Rock & Demark-Wahnefried, 2002). Unlike the effects of obesity on *de novo* breast cancer risk, which is different in pre- and postmenopausal women, the adverse effects of increased body weight on recurrence risk and survival have been evident in pre- and postmenopausal women, with tumors of worsened prognostic index found in obese patients (Carmichael, Bendall, Lockerbie, Prescott, & Bates, 2004; Chlebowski et al.; Daling et al., 2001; Goodwin et al., 2002). Although some studies suggest that obesity has little effect on breast cancer prognosis, obesity has an adverse effect on other factors that limit life span, such as cardiovascular disease, diabetes, and second primary cancers (Berclaz et al., 2004; Dignam et al., 2003; Fontaine et al., 2003). Studies on weight loss and breast cancer recurrence generally are lacking except for one small study conducted in Russia, where energy restriction of 15% in breast cancer survivors reduced recurrence rates by 72% three years after diagnosis (Sopotsinskaia et al., 1992). In early-stage breast cancer in women older than age 50 at diagnosis, however, the probability of death from other causes typically exceeds the risk of death from breast cancer (Schairer, Mink, Carroll, & Devesa, 2004), making general health a concern in breast cancer survivors.

Barriers to Successful Weight Loss in Breast Cancer Survivors

Efforts to treat obesity in breast cancer survivors are complicated by the psychological distress (or unsettled emotional state) and even depression that can result from receiving a diagnosis of breast cancer (Cella & Webster, 1997; Golden-Kreutz & Andersen, 2004; Gurevich, Devins, & Rodin, 2002). The presence of a definable psychiatric diagnosis in patients with breast cancer has been reported in 42%–49% of women (Jenkins et al., 2003; Kissane et al., 2004). Fatigue has been documented in 60%–90% of patients with cancer undergoing treatment (Wagner & Cella, 2004). Although QOL may improve over time, postdiagnosis impairments have been reported years after diagnosis (Fallowfield et al., 2004). In a study of African American patients with breast cancer four years after diagnosis, energy loss, sleep disturbance, and pain occurred in a large number of women, which resulted in decreased QOL (Northouse et al., 1999). A cross-sectional study of breast cancer survivors indicated that obesity, depressive symptoms, and aberrant eating behavior were interrelated (Rock et al., 2000). The physical and emotional repercussions of the diagnosis and treatment of breast cancer can only be intensified by the concomitant presence of obesity. Psychological stress and depression can hamper weight loss efforts (Jenkins et al.; Walcott-McQuigg, Sullivan, Dan, & Logan, 1995).

Another factor affecting patients with cancer is fatigue, which is the most common side effect of treatment with chemotherapy; it also may occur in those treated with radia-

tion therapy (Courneya, 2003; Mock et al., 2001; Segal et al., 2001). Fatigue has been shown to negatively affect physical activity levels (Cella & Webster, 1997; Courneya & Friedreich, 1999; Gurevich et al., 2002). Exercise interventions can improve fatigue, depression, anxiety, mood, self-esteem, physical QOL, satisfaction with life, and overall QOL (Courneya). A randomized trial of postmenopausal breast cancer survivors after treatment found that exercise increased QOL (using the Functional Assessment of Cancer Therapy [FACT]–Breast), as well as fatigue and self-esteem (Courneya et al., 2003). However, no studies have reported on the QOL effects on patients with cancer after a weight loss intervention. In other populations, health-related QOL typically does improve with weight loss and returns to baseline levels at follow-up when weight is regained (Kaukua, Pekkarinen, Sane, & Mustajoki, 2003).

Study Goals

Although weight loss should improve QOL, not all subjects adhere to interventions. Identification of factors associated with successful weight loss in obese breast cancer survivors is needed. In females without cancer, poor QOL is one factor that predicted noncompletion in a weight management study (Teixeira et al., 2004). Therefore, the current study's researchers investigated whether a simple QOL instrument can identify factors associated with successful weight loss. Patients with higher QOL were posited to achieve greater weight loss because they would be more capable of adhering to exercise and diet recommendations for weight loss. In addition, the current study explored whether weight loss influenced QOL measures after 12 months of intervention, analogous to that described previously for exercise interventions in patients with cancer (Courneya, 2003).

Methods

Subjects

The methods for the entire study have been described in detail elsewhere (Djuric et al., 2002). Briefly, 48 obese subjects who had been diagnosed and treated for stage I or II breast cancer fewer than three years previously were eligible to participate. All subjects had completed cancer therapy, with the exception of hormonal therapies, at least three months prior. The study was approved by the Human Investigation Committee of Wayne State University.

Procedures

Subjects were randomized to one of four groups for 12 months: (a) a control group that received only the National Cancer Institute's "Action Guide to Healthy Eating" and the "Food Guide Pyramid" pamphlets without any other instruction, (b) a Weight Watchers® (Weight Watchers International, Inc., New York, NY) only group, (c) an intervention group that received one-on-one dietary counseling, and (d) a combined Weight Watchers and individualized counseling group. Individualized counseling included dietary advice to decrease total energy intake and avoid high-fat foods and a recommendation of moderate exercise for 30–45 minutes per day. The counseling was performed by telephone, weekly for three months, biweekly during months three through six, and monthly thereafter. Women assigned to the Weight Watchers groups received free coupons for attending meetings of their choosing.

Assessments

At baseline, women completed **demographic and health-history questionnaires**. At baseline and 6, 12, and 24 months, body weight was measured, and the **FACT-Anemia (FACT-An)**, version 4.0) QOL instrument was administered (Cella, Eton, Lai, Peterman, & Merkel, 2002). The instrument was developed specifically to measure and compare QOL across various cancer diagnoses and treatments. The FACT-General (FACT-G) is part of the FACT-An and contains four subscales: physical (meeting daily needs without physical symptoms), emotional (degree of worry and sadness), social or family (good support), and functional (enjoyment and fulfillment). Summing across items for the physical, functional, social or family, and emotional subscales, the FACT-G yields a total score as well as individual subscale scores. The FACT-An adds 20 items, generating a fatigue score (13 items) and an anemia score (13 fatigue items and 7 additional items) to the FACT-G. All scales use a five-point Likert-type response format to obtain self-reports on the various QOL dimensions. Because of the modest sample size of the study, only baseline and 12-month data were analyzed.

Statistical Methods

All measurements and questionnaire data were analyzed using the SPSS® Statistical Package version 10.1 (SPSS Inc., Chicago, IL). Means and standard deviations were calculated for demographic characteristics, and body mass index was calculated as weight in kg divided by height in m². Changes in weight from baseline to 12 months were analyzed using paired t tests. The FACT-G overall scores and subscale scores were calculated using inversion of items as needed, such that higher scores indicated better functioning. Hierarchical regression analyses were used to evaluate the relationship of the diet arm and baseline QOL measures to weight loss at 12 months. The percent change in weight from baseline to 12 months was the dependent variable used to account for the effect that baseline weight imposed on the amount of weight lost. Because the diet arm previously was shown to have a significant effect on weight change, it was entered first as a control variable. Thus, the unique effect of QOL measures on weight loss was evaluated after controlling for the effects attributable to the dietary intervention itself.

To examine the effects of weight loss on QOL at 12 months with hierarchical regression analysis, baseline QOL, overall or subscale scores, and weight at 12 months were entered first, and then percent weight change was entered. This allowed for examination of the unique effect of the percent weight change on QOL at 12 months after controlling for baseline QOL and the effects of current weight. In all analyses, $p \leq 0.05$ was considered significant, and all tests were two tailed.

Results

Thirty-nine women completed 12 months on the study; six women dropped out after the baseline visit, one after three months, and two after six months. The mean baseline body mass index of the nine women who dropped out did not differ from those who remained in the study (35.9 kg/m² versus 35.5 kg/m², respectively). Demographic characteristics of the 39 women who completed 12 months are shown in Table 1. Eight (20%) of the subjects were African American.

Table 1. Baseline Characteristics of Women Completing 12 Months of a Dietary Intervention Trial

Characteristic	\bar{X}	SD	Range
Age (years)	52.1	8.5	36–70
Baseline weight (kg)	94.5	13.4	73–139
Body mass index (kg/m ²)	35.5	4.0	30–44
Weight at one year (kg)	90.0	16.6	56–144
Weight change from baseline to 12 months (lbs)	–10.0	17.1	–54 to 25
Weight change from baseline to 12 months (%)	–5.0	8.0	–27 to 11
Baseline overall quality of life (FACT-General)	88.5	11.1	62–106
Physical quality of life	23.2	3.3	14–28
Social quality of life	22.9	4.8	9–28
Emotional quality of life	19.4	3.5	11–24
Functional quality of life	23.0	3.8	11–28
FACT-Anemia	23.2	7.9	12–40
FACT-Fatigue	16.0	6.7	6–30

N = 39

FACT—Functional Assessment of Cancer Therapy

The mean weight change for the total group over one year averaged $-4.5 (\pm 7.7)$ kg and ranged from a loss of 24.5 kg to a gain of 11.3 kg. The mean weight change in the control and Weight Watchers-only diet arms was -0.5 kg (± 6.1 kg). The mean weight change in the individualized and combination diet arms was -8.7 kg ± 7.1 kg ($p = 0.003$), demonstrating the success of the individualized intervention. Age was not related to the extent of weight loss at one year ($p > 0.05$) nor to the baseline FACT-G overall score or any subscale scores (including anemia and fatigue) except social QOL ($r = 0.38$, $p < 0.02$).

The overall FACT-G score at baseline was not a significant predictor of weight loss at one year. Of the subscales examined, only the physical and functional subscale scores (see Table 2) were significantly related to weight loss; lower scores correlated with greater weight loss, accounting for 8%–9% of the variance in weight change over and above the 22% of variance accounted for by the diet arm. The positive beta indicates that self-evaluations of worse physical functioning at baseline were associated with greater weight loss at 12 months. The association of weight loss with scores on the functional subscale also was significant (i.e., subjects scoring lower in response to questions about enjoyment of life, fulfilling work, and being content and accepting of their diagnosis lost more weight than those who responded more positively). The emotional and social subscales were unrelated to subsequent weight loss, as were the scales of anemia and fatigue.

Table 3 shows the effects of weight loss on QOL measures after one year, controlling for baseline QOL measures and weight at 12 months in the hierarchical regression models. Increased weight loss was significantly associated with a higher score in overall QOL, physical QOL, functional QOL, anemia, and fatigue at 12 months. The analyses included weight at 12 months in the models, which was not a significant predictor of any of the QOL measures in the models after inclusion of weight change. Weight change accounted for 9%–18% of the variance in QOL beyond that accounted for by the baseline QOL measures.

Table 2. Significant Predictors of Weight Change at 12 Months

Model	Coefficient			
	B	SE	β	p
Constant	0.094	0.046	—	0.048
Diet arm assignment	−0.085	0.025	−0.472	0.002
$R^2 = 0.22$, $F = 10.61$				
Constant	−0.092	0.096	—	0.344
Diet arm assignment	−0.082	0.025	−0.453	0.002
Physical quality of life at baseline	−0.008	0.004	−0.301	0.036
$R^2 = 0.31$, $F = 8.20$				
Constant	−0.068	0.090	—	0.453
Diet arm assignment	−0.077	0.025	−0.043	0.005
Functional quality of life at baseline	0.006	0.009	0.289	0.047
$R^2 = 0.30$, $F = 7.88$				

SE—standard error

Discussion

Weight change in the current study varied greatly, ranging from a gain of 3.3% to a loss of 27.5% of baseline weight after 12 months of the intervention. The weight loss intervention involved counseling for dietary and exercise changes. Although several studies have examined exercise interventions in patients with cancer, less is known about the effects of weight loss interventions. Patients with breast cancer are unique in that weight loss typically does not occur during treatment, at least for early-stage disease, and weight gain is a worry (Freedman et al., 2004; Goodwin et al., 1999). In Goodwin et al.'s (1998) weight loss intervention, weight loss in patients with breast cancer was only 0.53 kg in one year, but health-related QOL (emotional, cognitive, and social functioning) improved significantly using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire 30. For exercise interventions in patients with breast cancer, improvement in fatigue is the one dimension of QOL that has been found rather consistently in several studies (Courneya et al., 2003; Headley, Ownby, & John, 2004; Mock et al., 2005; Stricker, Drake, Hoyer, & Mock, 2004; Turner, Hayes, & Reul-Hirche, 2004), including the present study. That finding is important because the mean anemia and fatigue scores in the current study's subjects were poor relative to the general population and other patients with solid tumors, whereas roughly average functioning was reported in the other domains (Cella et al., 2002; Cella, Kallich, McDermott, & Xu, 2004; Holzner et al., 2004).

The finding that age and most FACT-G scores were not related to the extent of weight loss at one year is unlike another study using a similar instrument that showed more severe QOL disturbances in patients with breast cancer who were younger than 50 years of age compared to those who were older (Wenzel et al., 1999). Additionally, disease recurrence likely did not affect weight loss in the current study because the subjects were treated for stage I or II breast cancer, which has low recurrence rates and was verified by a doctor's note that indicated no evidence of disease at study entry. The

women were followed for an additional year; one patient was diagnosed with a recurrence, and two were diagnosed with cancer in the contralateral breast (one of the cancers was in situ disease) during that time.

The present data show that the physical and functional QOL subscales were significant predictors of weight loss success in obese breast cancer survivors. Women who perceived lower physical and functional QOL at study entry were more successful at losing weight. The direction of the predictor was not necessarily intuitive, especially because the weight loss counseling included a recommendation for exercise; lower physical functioning might have been expected to interfere

Table 3. Significant Predictors of Quality of Life (QOL) at 12 Months

Model	Coefficient			
	B	SE	β	p
Baseline overall QOL	0.58	0.090	0.73	< 0.001
Weight at 12 months	−0.03	0.030	−0.12	0.28
$R^2 = 0.56$, $F = 23.81$				
Baseline overall QOL	0.68	0.090	0.85	< 0.001
Weight at 12 months	0.04	0.030	0.16	0.26
Weight change (%)	−43.35	14.400	−0.42	0.01
$R^2 = 0.65$, $F = 21.89$				
Baseline physical QOL	0.26	0.135	0.29	0.06
Weight at 12 months	−0.04	0.010	−0.38	0.02
$R^2 = 0.22$, $F = 4.96$				
Baseline physical QOL	0.43	0.130	0.47	0.00
Weight at 12 months	−0.05	0.010	0.00	1.00
Weight change (%)	−21.45	6.460	−0.61	0.00
$R^2 = 0.40$, $F = 7.89$				
Baseline functional QOL	0.44	0.090	0.62	< 0.001
Weight at 12 months	−0.04	0.010	−0.06	0.65
$R^2 = 0.39$, $F = 11.31$				
Baseline functional QOL	0.55	0.100	0.77	< 0.001
Weight at 12 months	−0.15	0.010	0.22	0.19
Weight change (%)	−14.25	5.490	−0.45	0.01
$R^2 = 0.49$, $F = 11.00$				
Baseline fatigue	0.37	0.120	0.41	0.01
Weight at 12 months	−0.09	0.030	−0.38	0.01
$R^2 = 0.43$, $F = 12.69$				
Baseline fatigue	0.44	0.110	0.49	< 0.001
Weight at 12 months	−0.14	0.040	−0.06	0.70
Weight change (%)	−45.98	14.390	−0.48	0.00
$R^2 = 0.56$, $F = 14.15$				
Baseline anemia	0.37	0.100	0.47	0.00
Weight at 12 months	−0.01	0.030	−0.38	0.01
$R^2 = 0.46$, $F = 14.49$				
Baseline anemia	0.43	0.100	0.55	< 0.001
Weight at 12 months	−0.03	0.040	−0.10	0.52
Weight change (%)	−44.25	16.260	−0.41	0.01
$R^2 = 0.56$, $F = 13.95$				

SE—standard error

with compliance with the exercise recommendations. The significance of the finding is increased by the results of a study of more than 500 patients with breast cancer who were treated with surgery, with and without chemotherapy (Ganz et al., 2004). Although emotional functioning was high in the study, all treatment groups reported impairment of physical functioning. The current study's results indicate that impaired physical functioning before weight loss intervention may not be an impediment to successful weight loss; rather, it may be a motivating force and result in even greater improvement in QOL. It might be especially important in the period after the initial six months of counseling, when continued weight loss becomes more difficult (Darga, Carroll-Michals, Botsford, & Lucas, 1991). The finding that weight loss at 12 months improved scores for physical and functional QOL, along with scores for fatigue and anemia (whereas emotional and social scores were not affected significantly) further supports the importance of physical factors in weight loss. With regard to the effects of weight loss on QOL, two other studies also have found that physical function is one of the factors affected most strongly and favorably by weight loss (Fontaine et al., 1999; Wenzel et al., 1999).

Increased attention has been given to QOL in the care and treatment of cancer (Arora et al., 2001; Cella, 1998; Fallowfield, Leaity, Howell, Benson, & Cella, 1999; Fontaine et al., 1999; Goodyear & Fraumeni, 1996; Kolotkin, Crosby, & Williams, 2002). Obesity and weight gain have been shown to result in decreased QOL in many studies (Fine et al., 1999; Kolotkin et al., 2001). Conversely, a decrease in weight has been associated with an increase in QOL after surgical intervention for severe obesity (Choban, Onyejekwe, Burge, & Flancbaum, 1999; Karlsson, Sjostrom, & Sullivan, 1998). Weight regain can return QOL scores to pre-weight loss levels (Engel et al., 2003). Interestingly, individuals with the lowest baseline health QOL had the largest weight loss (Engel et al.). Similarly, the current study showed that low physical and functional scores at baseline were associated with weight loss success in obese breast cancer survivors.

No significant association existed between weight loss and the emotional and social subscales, which is consistent with the observation in a large cohort of healthy nurses that weight change was associated more strongly with physical rather than mental health (Fine et al.). The current study's investigators demonstrated that the beneficial effects of weight loss on physical and functional QOL extend to obese breast cancer survivors; however, whether that was a result of the weight loss or the exercise that was part of the weight loss program is difficult to determine. Increased exercise has been shown to improve QOL in patients with breast and other cancers (Courneya, 2003).

Limitations of the present study included its small sample size and study attrition, which reduced the number of factors that could be assessed meaningfully. Furthermore, the small number of nonwhite subjects did not allow any subgroup analyses. The women who completed 12 months in the study were likely a highly motivated group and may be atypical of other obese breast cancer survivors, limiting generalizability of the results. Despite the limitations, the clear relationship between physical and functional QOL and weight loss may provide guidance for future studies and programs aimed at weight reduction.

In summary, the FACT-An, a relatively short and simple QOL questionnaire, revealed that physical and functional aspects of QOL were associated with weight loss success in obese breast cancer survivors. A weight loss counselor may be hesitant to promote exercise for weight loss in those who complain of physical and functional problems at the outset, yet the study results indicate that individuals with self-reports of low physical and functional QOL can be more successful at weight loss. Weight loss increased scores in the two measures as well as overall QOL, fatigue, and symptoms of anemia. Therefore, weight loss information should be incorporated into the individualized counseling paradigm.

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References

- Arora, N.K., Gustafson, D.H., Hawkins, R.P., McTavish, F., Cella, D.F., Pingree, S., et al. (2001). Impact of surgery and chemotherapy on the quality of life of younger women with breast carcinoma: A prospective study. *Cancer*, 92, 1288–1298.
- Berclaz, G., Li, S., Price, K.N., Coates, A.S., Castiglione-Gertsch, M., Rudenstam, C.M., et al. (2004). Body mass index as a prognostic feature in operable breast cancer: The International Breast Cancer Study Group experience. *Annals of Oncology*, 15, 875–884.
- Carmichael, A.R., Bendall, S., Lockerbie, L., Prescott, R.J., & Bates, T. (2004). Does obesity compromise survival in women with breast cancer? *Breast*, 13, 93–96.
- Cella, D. (1998). Factors influencing quality of life in cancer patients: Anemia and fatigue. *Seminars in Oncology*, 25, 43–46.
- Cella, D., Eton, D.T., Lai, J.S., Peterman, A.H., & Merkel, D.E. (2002). Combining anchor and distribution-based methods to derive minimal clinically important differences on the Functional Assessment of Cancer Therapy (FACT) anemia and fatigue scales. *Journal of Pain and Symptom Management*, 24, 547–561.
- Cella, D., Kallich, J., McDermott, A., & Xu, X. (2004). The longitudinal relationship of hemoglobin, fatigue and quality of life in anemic cancer patients: Results from five randomized clinical trials. *Annals of Oncology*, 15, 979–986.
- Cella, D., & Webster, K. (1997). Linking outcomes management to quality-of-life measurement. *Oncology*, 11, 232–235.
- Chlebowski, R.T., Aiello, E., & McTiernan, A. (2002). Weight loss in breast cancer patient management. *Journal of Clinical Oncology*, 20, 1128–1143.
- Choban, P.S., Onyejekwe, J., Burge, J.C., & Flancbaum, L. (1999). A health status assessment of the impact of weight loss following Roux-en-Y gastric bypass for clinically severe obesity. *Journal of the American College of Surgeons*, 188, 491–497.
- Courneya, K.S. (2003). Exercise in cancer survivors: An overview of research. *Medicine and Science in Sports and Exercise*, 35, 1846–1852.
- Courneya, K.S., & Friedenreich, C.M. (1999). Physical exercise and quality of life following cancer diagnosis: A literature review. *Annals of Behavioral Medicine*, 21, 171–179.
- Courneya, K.S., Mackey, J.R., Bell, G.J., Jones, L.W., Field, C.J., & Fairey, A.S. (2003). Randomized controlled trial of exercise training in postmenopausal breast cancer survivors: Cardiopulmonary and quality of life outcomes. *Journal of Clinical Oncology*, 21, 1660–1668.
- Daling, J.R., Malone, K.E., Doody, D.R., Johnson, L.G., Gralow, J.R., & Porter, P.L. (2001). Relation of body mass index to tumor markers and survival among young women with invasive ductal breast carcinoma. *Cancer*, 92, 720–729.

- Darga, L.L., Carroll-Michals, L., Botsford, S.J., & Lucas, C.P. (1991). Fluoxetine's effect on weight loss in obese subjects. *American Journal of Clinical Nutrition*, 54, 321–325.
- Demark-Wahnefried, W., Peterson, B.L., Winer, E.P., Marks, L., Aziz, N., Marcom, P.K., et al. (2001). Changes in weight, body composition, and factors influencing energy balance among premenopausal breast cancer patients receiving adjuvant chemotherapy. *Journal of Clinical Oncology*, 19, 2381–2389.
- Dignam, J.J., Wieand, K., Johnson, K.A., Fisher, B., Xu, L., & Mamounas, E.P. (2003). Obesity, tamoxifen use, and outcomes in women with estrogen receptor-positive early-stage breast cancer. *Journal of the National Cancer Institute*, 95, 1467–1476.
- Djuric, Z., DiLaura, N.M., Jenkins, I., Darga, L., Jen, C.K., Mood, D., et al. (2002). Combining weight-loss counseling with the Weight Watchers plan for obese breast cancer survivors. *Obesity Research*, 10, 657–665.
- Engel, S.G., Crosby, R.D., Kolotkin, R.L., Hartley, G.G., Williams, G.R., Wonderlich, S.A., et al. (2003). Impact of weight loss and regain on quality of life: Mirror image or differential effect? *Obesity Research*, 11, 1207–1213.
- Enger, S.M., Greif, J.M., Polikoff, J., & Press, M. (2004). Body weight correlates with mortality in early-stage breast cancer. *Archives of Surgery*, 139, 954–958.
- Fallowfield, L., Cella, D., Cuzick, J., Francis, S., Locker, G., & Howell, A. (2004). Quality of life of postmenopausal women in the Arimidex, Tamoxifen, Alone, or in Combination (ATAC) adjuvant breast cancer trial. *Journal of Clinical Oncology*, 22, 4261–4271.
- Fallowfield, L.J., Leaity, S.K., 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 Research and Treatment*, 55, 189–199.
- Fine, J.T., Colditz, G.A., Coakley, E.H., Moseley, G., Manson, J.E., Willett, W.C., et al. (1999). A prospective study of weight change and health-related quality of life in women. *JAMA*, 282, 2136–2142.
- Fontaine, K.R., Barofsky, I., Andersen, R.E., Bartlett, S.J., Wiersema, L., Cheskin, L.J., et al. (1999). Impact of weight loss on health-related quality of life. *Quality of Life Research*, 8, 275–277.
- Fontaine, K.R., Redden, D.T., Wang, C., Westfall, A.O., & Allison, D.B. (2003). Years of life lost due to obesity. *JAMA*, 289, 187–193.
- Freedman, R.J., Aziz, N., Albanes, D., Hartman, T., Danforth, D., Hill, S., et al. (2004). Weight and body composition changes during and after adjuvant chemotherapy in women with breast cancer. *Journal of Clinical Endocrinology and Metabolism*, 89, 2248–2253.
- Ganz, P.A., Kwan, L., Stanton, A.L., Krupnick, J.L., Rowland, J.H., Meyerowitz, B.E., et al. (2004). Quality of life at the end of primary treatment of breast cancer: First results from the Moving Beyond Cancer randomized trial. *Journal of the National Cancer Institute*, 96, 376–387.
- Golden-Kreutz, D.M., & Andersen, B.L. (2004). Depressive symptoms after breast cancer surgery: Relationships with global, cancer-related, and life event stress. *Psycho-Oncology*, 13, 211–220.
- Goodwin, P., Esplen, P., Butler, K., Winocur, J., Pritchard, K., Brazel, S., et al. (1998). Multidisciplinary weight management in locoregional breast cancer: Results of a phase II study. *Breast Cancer Research and Treatment*, 48, 53–64.
- Goodwin, P.J., Ennis, M., Pritchard, K.I., McCready, D., Koo, J., Sidlofsky, S., et al. (1999). Adjuvant treatment and onset of menopause predict weight gain after breast cancer diagnosis. *Journal of Clinical Oncology*, 17, 120–129.
- Goodwin, P.J., Ennis, M., Pritchard, K.I., Trudeau, M.E., Koo, J., Madarnas, Y., et al. (2002). Fasting insulin and outcome in early-stage breast cancer: Results of a prospective cohort study. *Journal of Clinical Oncology*, 20, 42–51.
- Goodyear, M.D., & Fraumeni, M.A. (1996). Incorporating quality of life assessment into clinical cancer trials. In B. Spilker (Ed.), *Quality of life and pharmacoeconomics in clinical trials* (2nd ed., pp. 1003–1014). Philadelphia: Lippincott-Ravens.
- Gurevich, M., Devins, G.M., & Rodin, G.M. (2002). Stress response syndromes and cancer: Conceptual and assessment issues. *Psychosomatics*, 43, 259–281.
- Headley, J.A., Ownby, K.K., & John, L.D. (2004). The effect of seated exercise on fatigue and quality of life in women with advanced breast cancer. *Oncology Nursing Forum*, 31, 977–983.
- Holzner, B., Kemmler, G., Cella, D., De Paoli, C., Meraner, V., Kopp, M., et al. (2004). Normative data for Functional Assessment of Cancer Therapy—General scale and its use for the interpretation of quality of life scores in cancer survivors. *Acta Oncologica*, 43, 153–160.
- Jenkins, I., Djuric, Z., Darga, L., DiLaura, N.M., Magnan, M., & Hryniuk, W.M. (2003). Relationship of psychiatric diagnosis and weight loss maintenance in obese breast cancer survivors. *Obesity Research*, 11, 1369–1375.
- Karlsson, J., Sjostrom, L., & Sullivan, M. (1998). Swedish obese subjects (SOS)—An intervention study of obesity. Two-year follow-up of health-related quality of life (HRQL) and eating behavior after gastric surgery for severe obesity. *International Journal of Obesity and Related Metabolic Disorders*, 22, 113–126.
- Kaukua, J., Pekkarinen, T., Sane, T., & Mustajoki, P. (2003). Health-related quality of life in obese outpatients losing weight with very-low-energy diet and behaviour modification—A 2-year follow-up study. *International Journal of Obesity and Related Metabolic Disorders*, 27, 1233–1241.
- Kissane, D.W., Grabsch, B., Love, A., Clarke, D.M., Bloch, S., & Smith, G.C. (2004). Psychiatric disorder in women with early stage and advanced breast cancer: A comparative analysis. *Australian and New Zealand Journal of Psychiatry*, 38, 320–326.
- Kolotkin, R.L., Crosby, R.D., & Williams, G.R. (2002). Health-related quality of life varies among obese subgroups. *Obesity Research*, 10, 748–756.
- Kolotkin, R.L., Meter, K., & Williams, G.R. (2001). Quality of life and obesity. *Obesity Reviews*, 2, 219–229.
- Kroenke, C.H., Chen, W.Y., Rosner, B., & Holmes, M.D. (2005). Weight, weight gain, and survival after breast cancer diagnosis. *Journal of Clinical Oncology*, 23, 1370–1378.
- Marchesini, G., Bellini, M., Natale, S., Belsito, C., Isacco, S., Nuccitelli, C., et al. (2003). Psychiatric distress and health-related quality of life in obesity. *Diabetes, Nutrition and Metabolism*, 16, 145–154.
- Maru, S., van der Schouw, Y.T., Gimbrere, C.H., Grobbee, D.E., & Peeters, P.H. (2004). Body mass index and short-term weight change in relation to mortality in Dutch women after age 50. *American Journal of Clinical Nutrition*, 80, 231–236.
- McInnes, J.A., & Knopf, M.T. (2001). Weight gain and quality of life in women treated with adjuvant chemotherapy for early-stage breast cancer. *Oncology Nursing Forum*, 28, 675–684.
- Mock, V., Frangakis, C., Davidson, N.E., Ropka, M.E., Pickett, M., Poniatowski, B., et al. (2005). Exercise manages fatigue during breast cancer treatment: A randomized controlled trial. *Psycho-Oncology*, 14, 464–477.
- Mock, V., Pickett, M., Ropka, M.E., Muscarì Lin, E., Stewart, K.J., Rhodes, V.A., et al. (2001). Fatigue and quality of life outcomes of exercise during cancer treatment. *Cancer Practice*, 9, 119–127.
- National Center for Health Statistics. (2002). *Health, United States 2002*. Hyattsville, MD: Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics.
- National Heart, Lung, and Blood Institute Obesity Education Initiative. (1998). *Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults* [NIH Publication No. 98-4083]. Bethesda, MD: National Institutes of Health.
- Northouse, L.L., Caffey, M., Deichelbohrer, L., Schmidt, L., Guziatke-Trojniak, L., West, S., et al. (1999). The quality of life of African American women with breast cancer. *Research in Nursing and Health*, 22, 449–460.
- Pi-Sunyer, F.X. (2002). The obesity epidemic: Pathophysiology and consequences of obesity. *Obesity Research*, 10(Suppl. 2), 97S–104S.
- Roberts, R.E., Deleger, S., Strawbridge, W.J., & Kaplan, G.A. (2003). Prospective association between obesity and depression: Evidence from the Alameda County Study. *International Journal of Obesity and Related Metabolic Disorders*, 27, 514–521.
- Rock, C.L., & Demark-Wahnefried, W. (2002). Can lifestyle modification increase survival in women diagnosed with breast cancer? *Journal of Nutrition*, 132(11, Suppl.), 3504S–3507S.
- Rock, C.L., McEligot, A.J., Flatt, S.W., Sobo, E.J., Wilfley, D.E., Jones, V.E.,

- et al. (2000). Eating pathology and obesity in women at risk for breast cancer recurrence. *International Journal of Eating Disorders*, 27, 172–179.
- Schairer, C., Mink, P.J., Carroll, L., & Devesa, S.S. (2004). Probabilities of death from breast cancer and other causes among female breast cancer patients. *Journal of the National Cancer Institute*, 96, 1311–1321.
- Segal, R., Evans, W., Johnson, D., Smith, J., Colletta, S., Gayton, J., et al. (2001). Structured exercise improves physical functioning in women with stages I and II breast cancer: Results of a randomized controlled trial. *Journal of Clinical Oncology*, 19, 657–665.
- Sopotsinskaia, E., Balitskii, K., Tarutinov, V., Zhukova, V., Semenchuk, D., Kozlovskaya, S., et al. (1992). Experience with the use of a low-calorie diet in breast cancer patients to prevent metastasis. *Voprosy Onkologii*, 38, 592–599.
- Stricker, C.T., Drake, D., Hoyer, K.A., & Mock, V. (2004). Evidence-based practice for fatigue management in adults with cancer: Exercise as an intervention. *Oncology Nursing Forum*, 31, 963–976.
- Teixeira, P.J., Going, S.B., Houtkooper, L.B., Cussler, E.C., Metcalfe, L.L., Blew, R.M., et al. (2004). Pretreatment predictors of attrition and successful weight management in women. *International Journal of Obesity and Related Metabolic Disorders*, 28, 1124–1133.
- Turner, J., Hayes, S., & Reul-Hirche, H. (2004). Improving the physical status and quality of life of women treated for breast cancer: A pilot study of a structured exercise intervention. *Journal of Surgical Oncology*, 86, 141–146.
- Wagner, L.I., & Cella, D. (2004). Fatigue and cancer: Causes, prevalence, and treatment approaches. *British Journal of Cancer*, 91, 822–828.
- Walcott-McQuigg, J.A., Sullivan, J., Dan, A., & Logan, B. (1995). Psychosocial factors influencing weight control behavior of African American women. *Western Journal of Nursing Research*, 17, 502–520.
- Wenzel, L.B., Fairclough, D.L., Brady, M.J., Cella, D., Garrett, K.M., Kluhsman, B.C., et al. (1999). Age-related differences in the quality of life of breast carcinoma patients after treatment. *Cancer*, 86, 1768–1774.
- Yabroff, K.R., Lawrence, W.F., Clauser, S., Davis, W.W., & Brown, M.L. (2004). Burden of illness in cancer survivors: Findings from a population-based national sample. *Journal of the National Cancer Institute*, 96, 1322–1330.