



HHS Public Access

Author manuscript

Support Care Cancer. Author manuscript; available in PMC 2019 June 01.

Published in final edited form as:

Support Care Cancer. 2018 June ; 26(6): 1993–2004. doi:10.1007/s00520-018-4045-0.

Acceptance and Commitment Therapy for Symptom Interference in Metastatic Breast Cancer Patients: A Pilot Randomized Trial

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Compliance with Ethical Standards

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

Conflict of Interest: The authors declare that they have no conflict of interest.

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Abstract

Purpose—Breast cancer is the leading cause of cancer mortality in women worldwide. With medical advances, metastatic breast cancer (MBC) patients often live for years with many symptoms that interfere with activities. However, there is a paucity of efficacious interventions to address symptom-related suffering and functional interference. Thus, this study examined the feasibility and preliminary efficacy of telephone-based acceptance and commitment therapy (ACT) for symptom interference with functioning in MBC patients.

Methods—Symptomatic MBC patients ($N=47$) were randomly assigned to six telephone sessions of ACT or six telephone sessions of education/support. Patients completed measures of symptom interference and measures assessing the severity of pain, fatigue, sleep disturbance, depressive symptoms, and anxiety.

Results—The eligibility screening rate (64%) and high retention (83% at 8 weeks post-baseline) demonstrated feasibility. When examining within-group change, ACT participants showed decreases in symptom interference (i.e., fatigue interference and sleep-related impairment; Cohen's d range = $-.23$ to $-.31$) at 8 and 12 weeks post-baseline, whereas education/support participants showed minimal change in these outcomes (d range = $-.03$ to $.07$). Additionally, at 12 weeks post-baseline, ACT participants showed moderate decreases in fatigue and sleep disturbance (both d s = $-.43$), whereas education/support participants showed small decreases in these outcomes (d s = $-.24$ and $-.18$ for fatigue and sleep disturbance, respectively). Both the ACT and education/support groups showed reductions in depressive symptoms (d s = $-.27$ and $-.28$) at 12 weeks post-baseline. Group differences in all outcomes were not statistically significant.

Conclusions—ACT shows feasibility and promise in improving fatigue and sleep-related outcomes in MBC patients and warrants further investigation.

Keywords

metastatic breast cancer; acceptance and commitment therapy; psychosocial interventions; symptom interference; fatigue; sleep

Introduction

With an estimated 522,000 deaths in 2012 alone, breast cancer is the leading cause of cancer death in women worldwide [1]. While there are medical advances to increase the longevity of metastatic breast cancer (MBC) patients, important symptoms persist that are a major

source of suffering, impairment, and disability [2–8]. The most prevalent, persistent, and disabling symptoms in MBC patients include pain, fatigue, sleep disturbance, depression, and anxiety [2,9–12]. Research suggests that over half of MBC patients have significant levels of pain or fatigue, which often co-occur with sleep problems [2,5,13]. Indeed, over 60% report at least one type of sleep disturbance (e.g., waking in the night) [11], and worsening depression has predicted increased sleep disturbance over time [12]. Depression and anxiety also affect a substantial number of MBC patients, with 36% having one or both of these disorders [9].

Psychological and physical symptoms have been found to interfere with daily activities of MBC patients [5,6]. In a cross-sectional study, greater global symptom severity and interference showed moderate to strong correlations with decreased work productivity and activity engagement in this population [5]. Another study of MBC patients found that increases in depressive symptoms predicted greater social and recreational activity disruption during a 3-month period [6].

To date, non-pharmacologic interventions to reduce symptoms and distress in MBC patients have shown limited evidence of efficacy [14,15]. A 2013 Cochrane meta-analysis of 10 randomized controlled trials (RCTs) found that psychosocial interventions for MBC patients, most of which were group cognitive-behavioral or supportive expressive psychotherapy, only produced small, short-term improvement in pain and distress [14]. Similar conclusions were made in a recent systematic review of psychosocial interventions for MBC patients that included five additional RCTs [15]. Novel intervention approaches are needed to significantly decrease symptom-related suffering and interference with daily activities.

One psychosocial intervention that shows potential for reducing symptom-related suffering in cancer patients is acceptance and commitment therapy (ACT) [16]. In contrast to traditional cognitive-behavioral interventions that focus on symptom reduction and modifying maladaptive thoughts [17,18], the goal of ACT is to increase psychological flexibility so that unwanted internal experiences (e.g., physical symptoms, feelings, thoughts) interfere less with patients' engagement in meaningful activities [19]. Psychological flexibility involves fully experiencing the present moment while engaging in actions consistent with personal values [20]. This flexibility is developed through ACT's six core processes – mindfulness, perspective taking, cognitive defusion, acceptance, values clarification, and committed action [20] – and has been related to reduced anxiety and depressive symptoms and improved well-being in cancer patients [21,22].

ACT is efficacious for decreasing distress and promoting physical well-being and self-management in patients with medical conditions, such as diabetes and chronic pain [23,24]. For example, a systematic review of 10 RCTs of ACT for patients with chronic pain concluded that ACT enhances physical functioning and decreases distress when compared to control conditions [23]. Recently, ACT has been applied to cancer patients in several pilot trials [25]. Additionally, one RCT with late-stage ovarian cancer patients found large improvement in distress and quality of life among ACT participants compared to those

assigned to cognitive-behavioral therapy [26]. These preliminary findings suggest that ACT warrants further study in patients with advanced cancer.

We developed an ACT intervention to reduce symptom interference (i.e., the degree to which symptoms interfere with cognition, mood, and activities) among MBC patients. The intervention protocol was an adaptation of ACT to cancer symptom management based on two manuals [16,27]. The intervention emphasizes mindfulness practice; acceptance of thoughts, feelings, and physical symptoms through the use of metaphors and experiential exercises; clarification of personal values; and engagement in actions consistent with these values. We tailored the intervention to the experiences of MBC patients who often have high physical and psychological symptom burden [7] and delivered it via telephone to enhance feasibility for patients in rural areas and those with physical impairments.

This pilot trial tested the feasibility and preliminary efficacy of ACT relative to an education/support condition that controlled for time and attention. We enrolled MBC patients who had moderate to severe levels of at least one of five common symptoms (i.e., pain, fatigue, sleep disturbance, depressive symptoms, or anxiety). Feasibility was assessed via recruitment, retention, and session completion rates. Preliminary efficacy was assessed via ACT's impact on symptom interference (i.e., global symptom interference, pain interference, fatigue interference, and sleep-related impairment) compared to the education/support condition. Although distress and symptom reduction is not the primary goal of ACT, this intervention has led to improvement in mood and symptoms in some trials with medical populations, including cancer patients [23–25]. Thus, we compared the two interventions with respect to severity of pain, fatigue, sleep disturbance, depressive symptoms, and anxiety. We also examined within-group changes relative to baseline for all study outcomes.

Methods

Participants

Eligible patients had been diagnosed with stage IV breast cancer at least 3 weeks prior to enrollment and had at least one moderate to severe symptom, defined by T-scores ≥ 55 (at least one-half standard deviation above the population mean) on a 3-item Patient Reported Outcomes Measurement Information System (PROMIS) measure of pain severity or 4-item PROMIS measures of fatigue, sleep disturbance, depressive symptoms, or anxiety [28,29]. Patients were excluded if they 1) had severe cognitive impairment defined as 3 or more errors on a six-item cognitive screener [30]; 2) had a self-reported Eastern Cooperative Oncology Group (ECOG) score > 2 (able to do little activity) [31,32]; 3) were receiving hospice care at the time of enrollment; or 4) lacked English fluency.

Procedures

Participants were recruited from the Indiana University (IU) Simon Cancer Center in Indianapolis, IN between March and November 2016. The IU institutional review board approved all study procedures. Initial patient eligibility was determined via chart review and consultation with the attending oncologist. Letters of invitation and consent forms were

mailed to patients approved for contact. Trained research assistants called patients to screen for eligibility and obtain informed consent.

Consenting patients completed baseline telephone assessments and were randomly assigned to either the ACT or education/support condition. Randomization was performed by a person who was not a study interviewer or therapist using a SAS procedure and was stratified by patient performance status (self-reported ECOG scores 0 or 1 vs. 2) because this factor informs cancer treatment decision-making [33]. Patients completed follow-up telephone assessments at 8 and 12 weeks post-baseline and received \$25 gift cards for each assessment. Trained research assistants administering the assessments were blind to study condition.

Measures

Primary and secondary outcomes were assessed with valid self-report measures that have been used with cancer patients. Higher scores on each measure indicate greater symptom interference or severity. In this study, Cronbach's alphas across all measures ranged from .74 to .96.

Primary Outcome—The primary outcome of symptom interference with cognition, mood, and activities was assessed with the following measures: 1) 6-item global symptom interference subscale of the MD Anderson Symptom Inventory (MDASI) [34]; 2) the 4-item PROMIS scale for pain interference [35]; 3) seven interference items from the Fatigue Symptom Inventory (FSI) [36]; and 4) the 8-item PROMIS scale for sleep-related impairment [37].

Secondary Outcomes—The following measures assessed the severity of physical symptoms: 1) the 3-item PROMIS pain intensity measure; 2) the 4-item PROMIS short-form fatigue measure; and 3) the 4-item PROMIS short-form sleep disturbance measure [28,29]. In addition, depressive and anxiety symptoms were assessed with the 4-item PROMIS short-form depression measure and 4-item PROMIS short-form anxiety measure, respectively [38].

Sociodemographic and Medical Variables—At baseline, patients reported their demographics and mental health service use. Patient medical information was collected via chart review.

Study Conditions

Patients in both study conditions (ACT and education/support) were asked to complete six weekly 50 to 60-minute telephone sessions, which were audiorecorded. Six sessions is comparable to the duration of other interventions with this population [15]. The ACT condition was delivered by a master's level social worker with experience in ACT, whereas the education/support condition was delivered by a Ph.D. student in clinical psychology with experience in psychoeducation. The therapists were trained and supervised by two psychologists. Training consisted of didactics and role-plays of treatment sessions detailed in manuals. Supervision was weekly. Fidelity checklists were developed for both study

conditions, and one of the psychologists randomly selected 18% of audiorecordings to review for adherence to the manuals. The average fidelity rating was 99%. Both psychologists provided feedback on treatment adherence and quality.

ACT Condition—The ACT intervention incorporated all key processes of the ACT model of behavior change, including mindfulness, perspective taking, cognitive defusion, acceptance, values clarification, and committed action [20]. The intervention had a particular emphasis on developing mindfulness skills, engaging in actions consistent with personal values, and responding more effectively to symptoms. Each patient was mailed handouts summarizing the topics of each session and a CD with guidance for mindfulness practices. Table 1 shows a summary of the intervention components.

During the first session, the patient's background and strategies for managing symptoms were discussed and the concept of mindfulness was introduced. Across the six sessions, patients practiced various mindfulness exercises, clarified their values, and set specific actions to pursue in alignment with their values. During each session, the therapist assessed the patient's home practice of mindfulness and other skills and ended with a discussion of home practice for the week ahead. Although each participant learned the same set of skills, in-session and home practices were tailored to their cancer-related experiences and other challenges.

Education/support Condition—Similar to other psychosocial intervention trials for advanced cancer [39,40], the comparison group was an education/support condition. The intervention involves directing patients to resources for practical and health information and contact information for psychosocial services. A summary of the education/support components is found in Table 1. The sessions included the following topics: orientation to the medical center and treatment team; the effects of cancer on quality of life; resources for psychosocial support, health information, and financial concerns; and strategies for evaluating health information in books, magazines, and websites. Sessions were not tailored to each participant, except for the omission of topics that did not apply to the participant. Each patient was mailed handouts summarizing the topics for each session and was asked to review them at home.

Statistical Analyses

Descriptive statistics were computed to examine feasibility indicators. Baseline comparisons of study conditions (Fisher's exact tests and *t*-tests) were conducted. Linear mixed-effects model analyses (SAS Proc Mixed) were used to assess the preliminary efficacy of ACT, and an intent-to-treat framework was implemented. The last observation carried forward method was used to address missing data. Models included the baseline value of the outcome as a covariate and the main effects of time (8 vs. 12 weeks post-baseline) and study group (ACT vs. education/support). Both time and study group were categorical variables in these models, which focuses the analysis on mean differences across groups and time. A treatment effect is indicated by a significant study group main effect. Two-sided *p*-values < .05 were considered statistically significant. To calculate effect sizes for within-group changes, the

means of the differences between baseline and each follow-up were divided by the standard deviations of the change.

Results

Feasibility

Of the 158 MBC patients who were approached, 50 consented, 50 declined to participate, 38 were ineligible, and 20 could not be reached via phone. Primary reasons for declining were lack of interest and time constraints. Most ineligible patients did not meet the symptom criterion for study entry. Forty-seven of 50 consenting patients completed the baseline assessment and were included in the current analyses (Fig. 1). Retention was high, with 17/23 women in the ACT condition and 22/24 women in the education/support condition completing all six sessions. Additionally, 83% (39/47) completed the 8-week follow-up, and 79% (37/47) completed the 12-week follow-up. Retention rates did not differ by study condition.

Participant Characteristics

Table 2 shows participant characteristics by study group and group comparisons at baseline. All participants were women and most were Caucasian. Participants had, on average, completed some college, and the median annual household income was above \$50,000. No significant baseline differences on demographic or medical factors were found for patients randomized to ACT and education/support conditions, with the exception of radiation receipt. Regarding study outcomes at baseline, the ACT group showed higher levels of global symptom interference, fatigue interference, sleep-related impairment, and sleep disturbance than the education/support group (Table 2).

Patient symptom outcomes at baseline were compared to population norms for PROMIS measures. Elevated levels of a symptom outcome were defined as T-scores ≥ 60 (+1 SD). Thirty percent of patients had elevated pain interference, and 28% had elevated sleep-related impairment. Regarding symptom severity, 2% reported elevated pain, and 19% reported elevated sleep disturbance. Fatigue was the most prevalent problem, with 47% reporting elevations of this symptom. Regarding psychological symptoms, 19% had elevated depressive symptoms and 17% had elevated anxiety.

Preliminary Efficacy

Primary Outcomes—Results of the mixed-effects model analyses revealed no main effects of study group for indicators of patient symptom interference (i.e., global symptom interference, pain interference, fatigue interference, sleep-related impairment; Table 3). There were also no main effects of time, suggesting that primary outcome variables did not change on average between 8 and 12 weeks post-baseline.

Effect sizes for the mean change in primary outcomes from baseline to 8 and 12 weeks were computed for each study group (Table 4). Regarding change in global symptom interference, the ACT group showed small decreases ($d_s = -.19$ and $-.14$) and the education/support group showed small increases ($d_s = .11$ and $.20$) in this outcome (Fig. 2a). For both study

groups, effect sizes for change in pain interference were near zero, with the exception of a small decrease for the education/support group ($d = -.19$) at 8 weeks post-baseline (Fig. 2b). Regarding change in fatigue interference and sleep-related impairment, small to moderate decreases were found for the ACT group (d range = $-.23$ to $-.31$), whereas the education/support group had effect sizes close to zero at both follow-ups (Fig. 2c and 2d).

Secondary Outcomes—Results of the mixed-effects model analyses revealed no main effects of study group on patient symptom severity, including pain, fatigue, depressive symptoms, and anxiety (Table 3). However, there was a significant main effect of time on pain, indicating that patients in both groups, on average, reported a small increase in pain between 8 and 12 week follow-ups.

Effect sizes for mean change in exploratory outcomes from baseline to 8 and 12 weeks were also computed for each study group (Table 4). At the 12-week follow-up, the ACT group showed moderate decreases in fatigue and sleep disturbance (both d s = $-.43$), whereas the education/support group showed small decreases in these outcomes (d s = $-.24$ and $-.18$ for fatigue and sleep disturbance, respectively). Also at 12-week follow-up, reductions in depressive symptoms were nearly identical for both groups (d s = $-.27$ for ACT and $-.28$ for education/support), and small reductions in anxiety were found (d s = $-.18$ for ACT and $-.08$ for education/support). Little change in pain intensity also was observed at 12-week follow-up (d s = $-.14$ for ACT and $.03$ for education/support).

Discussion

This study examined the feasibility and preliminary efficacy of a 6-session, telephone-based ACT intervention for symptom interference in MBC patients. The intervention showed strong evidence of feasibility. The majority (64%) of patients who could be reached via phone were screened for eligibility, and 94% of consenting patients were randomized to one of the study conditions. Additionally, retention was high with 83% of randomized patients completing the 8-week follow-up. Some evidence of preliminary efficacy also was obtained. When examining within-group change relative to baseline, the ACT group showed small to moderate decreases in fatigue interference and sleep-related impairment (d range = $-.23$ to $-.31$) at 8 and 12-week follow-ups, whereas the education/support group showed very minimal change in these outcomes. Furthermore, at 12-week follow-up, the ACT group showed moderate reductions in the severity of fatigue and sleep disturbance (both d s = $-.43$), whereas the education/support group showed only small reductions in these outcomes (d s = $-.24$ and $-.18$ for fatigue and sleep disturbance, respectively). Differences between study conditions were not statistically significant; however, because this is a pilot study, we focused on effect sizes rather than statistical significance, especially given group imbalances in primary outcomes at baseline. To date, the few psychotherapy trials for MBC patients with fatigue and sleep outcomes have not shown evidence of efficacy [14,15]. As all patients in the current trial had one or more clinically meaningful symptoms at screening, changes in symptom outcomes following a brief intervention are noteworthy and suggest that ACT warrants further investigation in this understudied population.

Although ACT has not been applied to physical symptom outcomes in cancer populations, this intervention has led to reduced fatigue in general population samples [41,42]. For example, an ACT trial targeting depressive symptoms in adults found that fatigue improved at 3-month follow-up relative to a waitlist control condition [41]. Furthermore, results of pilot studies suggest that interventions with similar components to ACT, such as mindfulness-based stress reduction (MBSR), may reduce fatigue interference and severity in post-treatment cancer survivors with persistent fatigue [43,44]. Mindfulness is a core element of ACT and may be a mechanism by which the intervention leads to reduced perceptions of symptom severity and interference [20]. For example, taking a non-judgmental stance towards symptoms during mindfulness practice may interrupt maladaptive reactions to them, such as rumination. Furthermore, ACT's emphasis on life values rather than symptom control may lead to more adaptive behaviors in service of stated values [20]. For instance, a patient may no longer avoid valued social activities when fatigued and may find that fatigue is less disruptive than previously perceived.

Both the ACT and education/support groups showed small decreases in depressive symptoms ($d_s = -.27$ and $-.28$) and anxiety ($d_s = -.18$ and $-.08$) between baseline and 12-week follow-up. A minority of patients in this study had high levels of depressive symptoms and anxiety at baseline, which limited room for improvement during the intervention period. In addition, the primary goal of ACT is not distress reduction, but rather living a full, meaningful life despite distress and other symptoms [16]. Nevertheless, ACT has resulted in reduced distress in a few pilot studies with cancer patients [25], and meta-analytic evidence suggests that ACT is an efficacious treatment for distress in patients with chronic pain [23]. In this study, education regarding quality-of-life issues and supportive listening resulted in reductions in depressive symptoms comparable to those in the ACT condition. This finding aligns with meta-analytic evidence suggesting that psychoeducation has significant short-term effects on distress in cancer patients [45].

Other outcomes in this study showed minimal change. On average, patients reported low levels of pain at baseline; thus, changes in pain interference and severity were small throughout the study period. Regarding global symptom interference, the ACT group showed small decreases ($d_s = -.19$ and $-.14$), whereas the education/support group showed small increases ($d_s = .11$ and $.20$) at 8 and 12-week follow-ups. The measure of global symptom interference referred to the degree to which "symptoms" interfered with mood and activities during the past 24 hours [34]. Thus, the lack of reference to specific symptoms and short time frame may have limited the measure's sensitivity to change in symptom interference.

Several research directions may build upon the present findings. First, enrolling MBC patients with a specific symptom that interferes with activities, rather than patients with a range of symptoms, may increase the likelihood of detecting change in the primary outcome. Additionally, the degree to which ACT and education/support confer benefits beyond usual care warrants investigation in a 3-arm trial. Finally, holding more intervention sessions may bolster the effect size and expanding this work to different intervention modalities (e.g., video-conferencing) may further enhance its reach and effectiveness.

Limitations of this study should be noted. About one-third of approached patients refused study participation, with the primary reason being lack of interest. The relatively small sample size limited statistical power for detecting effects and may have contributed to group imbalances on key outcomes at baseline, despite randomization. Thus, although we controlled for group differences at baseline, the ACT group had greater room for improvement on key outcomes. In addition, this study did not include follow-up assessments beyond 12 weeks post-baseline. Given that ACT involves the gradual development of skills, greater change in key outcomes may have been evidenced during a longer follow-up period. Finally, the sample consisted of primarily Caucasian and college-educated patients from a single institution in the midwestern United States. The extent to which findings generalize to diverse MBC patients warrants study.

In conclusion, this study supports the feasibility of a brief telephone-based ACT intervention for symptom interference in MBC patients. Preliminary effect size estimates suggest that ACT deserves further study, especially with respect to fatigue and sleep-related outcomes in this population. Given the high symptom burden in MBC patients [2–8] and the paucity of efficacious interventions to address their needs [14,15], developing and testing interventions to improve their symptom-related outcomes should be a high priority for future research.

Acknowledgments

This study was supported by a grant from the Walther Cancer Foundation. Catherine Mosher was supported by the National Cancer Institute (K07CA168883 and K05CA175048). Shelley Johns was supported by the National Cancer Institute (K05CA175048) and Walther Cancer Foundation (0175.01). Victoria Champion was supported by the National Cancer Institute (K05CA175048). The authors thank Susan Daily, B.S., RT(T), Kelly Chinh, B.S., Lauren Hall, LCSW, and Danielle B. Tometich, M.S., for their assistance with this study and the study participants for their time and effort. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Cancer Institute or Walther Cancer Foundation.

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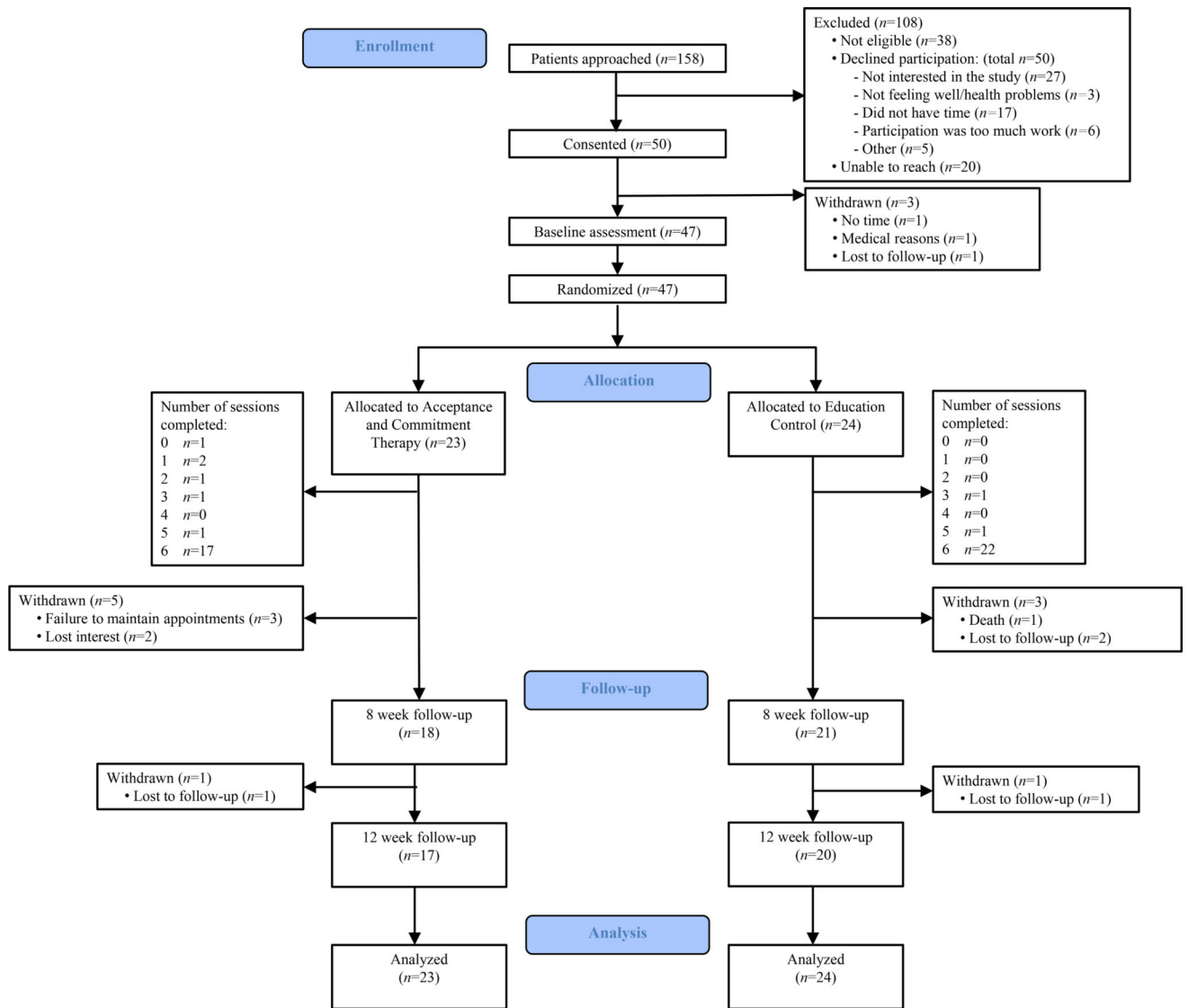
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Note. Patients could give multiple reasons for declining participation.

Fig. 1.
Study CONSORT diagram

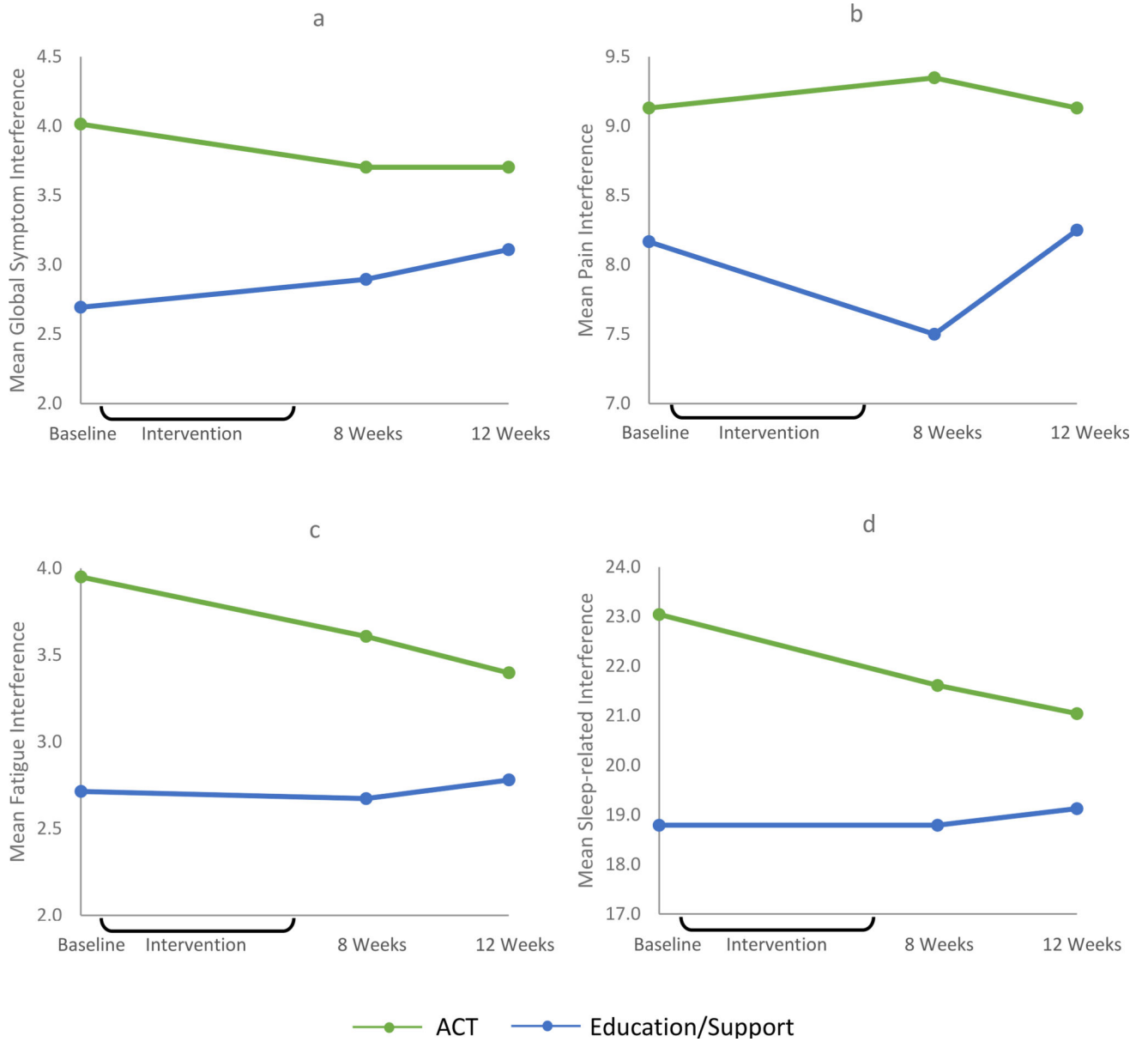


Fig. 2.
Changes in primary outcomes by study group

Table 1

Summary of Topics Covered in Each Intervention Condition

Acceptance and Commitment Therapy	Education/Support
<ul style="list-style-type: none"> • Discussion of current coping strategies for managing symptoms and suffering related to attempts to control symptoms and distress • Experiential practice of mindfulness during sessions and at home (e.g., noticing one’s breath, noticing an object/scene) • Practice with cognitive defusion--strategies to notice thoughts rather than being caught up in thoughts (e.g., passengers on the bus metaphor) • Cultivating a transcendent sense of self--a perspective from which to observe and accept all changing experiences (e.g., tell oneself “I’m noticing I’m having that thought/emotion/sensation”) • Identifying core values (e.g., being an involved and loving parent, contributing at work) • Identifying and practicing value-based actions, despite symptoms and distress 	<ul style="list-style-type: none"> • Orientation to the cancer center and treatment team, overview of quality of life issues, and discussion of physical quality of life • Discussion of social quality of life and referral to resources • Discussion of other aspects of quality of life (emotional and cognitive functioning and roles and activities) and referral to resources • Resources for managing financial challenges • Tips for evaluating health information in books, magazines, and websites • Review of prior sessions and referral to websites with cancer-related information

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Table 2

Patient Characteristics and Group Comparisons at Baseline

Characteristics	ACT (n = 23)	Education/ Support (n = 24)	t-test/ Fisher's Exact Test p
Age			0.08
Mean	59.30	53.29	
SD	11.95	10.93	
Range	27 – 75	32 – 71	
Race, n (%)			0.19
Non-Hispanic white	19 (82.61)	23 (95.83)	
Employment status, n (%)			0.13
Employed full or part-time	6 (26.09)	7 (29.17)	
Retired	10 (43.48)	4 (16.67)	
Unemployed	7 (30.43)	13 (54.17)	
Household income, n (%)			0.93
\$0 – \$50,999	7 (30.43)	8 (33.33)	
\$51,000 – \$99,999	9 (39.13)	8 (33.33)	
\$100,000 or more	6 (26.09)	8 (33.33)	
Missing	1 (4.35)	0 (0.00)	
Years of education			0.68
Mean (SD)	14.26 (2.09)	14.54 (2.55)	
Range	12 – 20	10 – 18	
Married/living with a partner, n (%)	17 (73.91)	15 (62.50)	0.53
Psychiatric medication, n (%) ^a	12 (52.17)	13 (54.17)	1.00
Psychotherapy/counseling, n (%) ^a	1 (4.35)	3 (12.50)	0.61
Years since diagnosis			0.59
Mean (SD)	4.87 (4.42)	4.25 (3.47)	
Range	0.51 – 16.35	0.23 – 15.85	
Treatments received, n (%)			
Mastectomy	13 (56.52)	13 (54.17)	1.00
Lumpectomy	8 (34.78)	7 (29.17)	0.76
Chemotherapy	19 (82.61)	19 (79.17)	1.00
Radiation	20 (86.96)	11 (45.83)	0.01
Hormonal therapy	16 (69.57)	21 (87.50)	0.17
Targeted therapy	11 (47.83)	15 (62.50)	0.39
Patient ECOG score at screening			0.68
Mean (SD)	1.13 (0.69)	1.04 (0.75)	
Range	0 – 2	0 – 2	
Global symptom interference at baseline			0.03
Mean (SD)	4.01 (2.14)	2.69 (1.85)	
Range	1.17 – 8.83	0.00 – 6.83	
Pain interference at baseline			0.44

Characteristics	ACT (n = 23)	Education/ Support (n = 24)	<i>t</i> -test/ Fisher's Exact Test <i>p</i>
Mean (SD)	9.13 (4.44)	8.17 (3.93)	
Range	4.00 – 20.00	4.00 – 17.00	
Fatigue interference at baseline			0.04
Mean (SD)	3.95 (2.34)	2.71 (1.71)	
Range	0.00 – 8.57	0.00 – 6.86	
Sleep-related impairment at baseline			0.04
Mean (SD)	23.04 (7.42)	18.79 (6.35)	
Range	9.00 – 40.00	10.00 – 32.00	
Pain at baseline			0.82
Mean (SD)	6.87 (2.78)	7.04 (2.20)	
Range	3.00 – 14.00	3.00 – 11.00	
Fatigue at baseline			0.20
Mean (SD)	13.43 (3.42)	12.04 (3.86)	
Range	7.00 – 20.00	4.00 – 17.00	
Sleep disturbance at baseline			0.03
Mean (SD)	13.39 (3.24)	11.50 (2.67)	
Range	7.00 – 18.00	6.00 – 16.00	
Depressive symptoms at baseline			0.25
Mean (SD)	8.04 (2.93)	7.00 (3.15)	
Range	4.00 – 14.00	4.00 – 15.00	
Anxiety at baseline			0.42
Mean (SD)	8.17 (2.99)	7.46 (3.02)	
Range	5.00 – 14.00	4.00 – 14.00	

ACT = Acceptance and Commitment Therapy; SD = standard deviation; ECOG = Eastern Cooperative Oncology Group.

^a Patient reported receiving treatment in the past month at baseline.

Table 3

Intent-to-Treat Results for Mixed-Effects Models Predicting Outcomes (N = 47)

Outcome Fixed Effect	β	SE	P
Primary Outcomes:			
Global symptom interference			
Baseline	0.77	0.13	<0.0001
Group	-0.31	0.52	0.55
Time	0.11	0.27	0.68
Pain interference			
Baseline	0.75	0.11	<0.0001
Group	0.64	0.92	0.49
Time	0.28	0.32	0.39
Fatigue interference			
Baseline	0.80	0.11	<0.0001
Group	-0.06	0.44	0.89
Time	-0.05	0.21	0.82
Sleep-related impairment			
Baseline	0.73	0.10	<0.0001
Group	-0.74	1.35	0.59
Time	-0.11	0.72	0.88
Exploratory Outcomes:			
Pain			
Baseline	0.69	0.12	<0.0001
Group	-0.02	0.58	0.97
Time	0.43	0.17	0.01
Fatigue			
Baseline	0.70	0.10	<0.0001
Group	-0.32	0.74	0.67
Time	-0.32	0.41	0.44
Sleep disturbance			
Baseline	0.59	0.13	<0.0001
Group	0.42	0.79	0.60
Time	-0.49	0.33	0.14
Depressive symptoms			
Baseline	0.65	0.10	<0.0001
Group	-0.04	0.62	0.94
Time	-0.21	0.26	0.42
Anxiety			
Baseline	0.46	0.10	<0.0001
Group	0.05	0.61	0.93
Time	-0.02	0.28	0.94

SE = standard error. For group effects, the education/support group is treated as the reference. For time effects, the first follow-up (8 weeks post-baseline) is treated as the reference.

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Table 4 Descriptive Statistics and Effect Sizes for Within-Group Change from Baseline (N = 47)

Outcome Fixed Effect	Change from Baseline to 8 Weeks Post-baseline		Change from Baseline to 12 Weeks Post-baseline		d
	Mean change	SD of change	Mean change	SD of change	
Primary Outcomes:					
Global symptom interference					
ACT	-0.31	1.64	-0.19	2.21	-0.14
Education/Support	0.20	1.90	0.11	2.09	0.20
Pain interference					
ACT	0.22	3.38	0.06	3.59	0.00
Education/Support	-0.67	3.42	-0.19	3.37	0.02
Fatigue interference					
ACT	-0.34	1.30	-0.26	2.43	-0.23
Education/Support	-0.04	1.64	-0.03	1.63	0.04
Sleep-related impairment					
ACT	-1.43	5.24	-0.27	6.55	-0.31
Education/Support	0.00	4.51	0.00	4.97	0.07
Exploratory Outcomes:					
Pain					
ACT	-0.30	1.92	-0.16	1.86	-0.14
Education/Support	-0.71	2.40	-0.29	2.50	0.03
Fatigue					
ACT	-1.09	3.06	-0.36	3.68	-0.43
Education/Support	-0.50	2.55	-0.20	2.81	-0.24
Sleep disturbance					
ACT	-0.43	3.06	-0.14	3.27	-0.43
Education/Support	-0.54	2.54	-0.21	3.23	-0.18
Depressive symptoms					
ACT	-0.74	2.47	-0.30	3.60	-0.27

Outcome Fixed Effect	Change from Baseline to 8 Weeks Post-baseline		Change from Baseline to 12 Weeks Post-baseline	
	Mean change	SD of change	Mean change	SD of change
Education/Support	-0.33	1.52	-0.22	1.91
Anxiety				
ACT	-0.52	2.35	-0.22	3.63
Education/Support	-0.29	2.54	-0.11	2.48
			<i>d</i>	<i>d</i>
			-0.54	-0.28
			-0.65	-0.18
			-0.21	-0.08

SD = standard deviation; ACT = Acceptance and Commitment Therapy.