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VOLUME 36 · NUMBER 23 · AUGUST 10, 2018

JOURNAL OF CLINICAL ONCOLOGY

ORIGINAL REPORT

Face-to-Face and Internet-Based Mindfulness-Based Cognitive Therapy Compared With Treatment as Usual in Reducing Psychological Distress in Patients With Cancer: A Multicenter Randomized Controlled Trial

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Published at jco.org on June 28, 2018.

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Clinical trial information: NCT02138513.

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0732-183X/18/3623w-2413w/$20.00

ABSTRACT

Purpose

Mindfulness-based cognitive therapy (MBCT) has been shown to alleviate psychological distress in patients with cancer. However, patients experience barriers to participating in face-to-face MBCT. Individual Internet-based MBCT (eMBCT) could be an alternative. The study aim was to compare MBCT and eMBCT with treatment as usual (TAU) for psychological distress in patients with cancer.

Patients and Methods

We obtained ethical and safety approval to include 245 patients with cancer with psychological distress (≥ 11 on the Hospital Anxiety and Depression Scale) in the study. They were randomly allocated to MBCT (n = 77), eMBCT (n = 90), or TAU (n = 78). Patients completed baseline (T0) and postintervention (T1) assessments. The primary outcome was psychological distress on the Hospital Anxiety and Depression Scale. Secondary outcomes were psychiatric diagnosis, fear of cancer recurrence, rumination, health-related quality of life, mindfulness skills, and positive mental health. Continuous outcomes were analyzed using linear mixed modeling on the intention-to-treat sample. Because both interventions were compared with TAU, the type I error rate was set at $P < .025$.

Results

Compared with TAU, patients reported significantly less psychological distress after both MBCT (Cohen's d, .45; $P < .001$) and eMBCT (Cohen's d, .71; $P < .001$) . In addition, post-treatment prevalence of psychiatric diagnosis was lower with both MBCT (33% improvement; $P = .030$) and eMBCT (29% improvement; $P = .076$) in comparison with TAU (16%), but these changes were not statistically significant. Both interventions reduced fear of cancer recurrence and rumination, and increased mental health–related quality of life, mindfulness skills, and positive mental health compared with TAU (all Ps $< .025$). Physical health–related quality of life did not improve ($P = .343$).

Conclusion

Compared with TAU, MBCT and eMBCT were similarly effective in reducing psychological distress in a sample of distressed heterogeneous patients with cancer.

J Clin Oncol 36:2413-2421. © 2018 by American Society of Clinical Oncology

INTRODUCTION

From 2025 onward, 20 million people worldwide will be diagnosed with cancer each year.[1] Approximately one third of patients with cancer suffer from significant psychological distress,[2] resulting in reduced quality of life, decreased compliance with medical care, and prolonged duration of hospital stay.[3,4] The prevalence of psychiatric disorders in oncologic settings is 30% to 40%.[3] Effective and accessible interventions are needed to reduce psychological distress and psychiatric disorders in patients with cancer.

Mindfulness-based interventions (MBIs)[5,6] such as mindfulness-based cognitive therapy (MBCT), teach participants to be more mindful in daily life through meditation exercises, yoga, group discussions, and didactic teaching.[5] A 2012 meta-analysis of randomized controlled trials (RCTs) of MBIs in 955 patients with cancer found significant improvements in depressive and anxiety symptoms.[7] Since then, a number of RCTs have confirmed this.[8-13]

ASSOCIATED CONTENT

Appendix
DOI: https://doi.org/10.1200/JCO.2017.76.5669

Data Supplements
DOI: https://doi.org/10.1200/JCO.2017.76.5669

DOI: https://doi.org/10.1200/JCO.2017.76.5669

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However, because MBIs typically require in-person attendance at classes over several weeks, many patients with cancer experience barriers to participation. These may include impairments due to illness and anticancer treatments, adverse effects that result in advice to avoid groups of people, or limited transportation options.[14] Consequently, uptake of face-to-face interventions for patients with cancer has been lower than, for instance, telephone-based interventions.[15]

In contrast, Internet-based interventions are easily accessible and save traveling time.[16] Therapist-guided Internet interventions have been shown to be effective for psychiatric and somatic conditions.[17] Although evidence for Internet-based MBIs (eMBIs) in cancer is scarce, one controlled study of 62 patients found that synchronous videoconferencing sessions led to significant improvements in mood, stress symptoms, and mindfulness skills,[18] In addition, an uncontrolled cohort of 257 fatigued patients showed significant improvements in fatigue and psychological distress after individual eMBCT.[19]

To date, no study has simultaneously compared the effectiveness of both MBCT and Internet-based MBCT (eMBCT) with treatment as usual (TAU). The primary aim of this RCT was to investigate whether MBCT and eMBCT were each superior to TAU in reducing psychological distress in a sample of distressed patients with cancer. Moreover, we hypothesized that there would be a reduction of psychiatric diagnoses, fear of cancer recurrence, and rumination, and an improvement in health-related quality of life, mindfulness skills, and positive mental health in both interventions compared with TAU. We explored moderators of intervention dropout and outcome in the interventions: sex, age, cancer diagnosis, anticancer treatment intent, psychiatric diagnosis, neuroticism, and therapist.

PATIENTS AND METHODS

Trial Design

A three-armed multicenter, parallel group RCT was conducted to compare the effectiveness of MBCT and eMBCT with TAU in reducing psychological distress in patients with cancer. Anticipated dropout rates were 15% in MBCT and TAU, and 30% in eMBCT.[19] Given the anticipated dropout rates, the allocation ratio was 1:1.2:1. Patients randomly assigned to receive TAU were secondarily randomly assigned to MBCT or eMBCT, to be given after the TAU period of 3 months. The study was approved by the ethical review board of the Radboud University Medical Center (CMO Arnhem-Nijmegen 2013/542). All centers provided local ethics approval. The study was registered on Clinicaltrials.gov (NCT02138513) shortly after the start of recruitment and was reported following CONSORT guidelines.[20] A protocol article was published in advance of trial completion.[21]

Participants

Inclusion criteria were (1) a cancer diagnosis, any tumor type or stage, at any time, receiving or not receiving treatment; (2) a score of ≥ 11 on the Hospital Anxiety and Depression Scale (HADS); (3) computer literacy and Internet access; (4) ability to participate in both MBCT and eMBCT; and (5) good command of the Dutch language. Exclusion criteria were (1) severe psychiatric morbidity, such as suicidal ideation and/or current psychosis; (2) change in psychotropic medication within a period of 3 months before baseline; and (3) previous participation in four or more sessions of an MBI.

Procedure

Patients were recruited from April 2014 to December 2015 via health care professionals in six centers (n = 64; 26%) via online media (n = 49; 20%), offline media (n = 44; 18%), patient associations (n = 43; 18%), and peers (n = 27; 11%). Eighteen patients (7%) could not remember how they heard about the study. Interested patients filled out the HADS on the research Web site. Patients with HADS ≥ 11 received a phone call from one of the researchers, during which the remaining inclusion and exclusion criteria were assessed. Once patients provided oral and written consent and had completed the baseline assessment, they were randomly assigned to MBCT, eMBCT, or TAU and informed about their allocation by E.B.

Intervention

Face-to-face MBCT. The MBCT protocol[6] was tailored to patients with cancer by including cancer-related psychoeducation and adapted movement exercises. The MBCT consisted of eight weekly 2.5-hour group sessions, a 6-hour silent day, and daily home practice assignments guided by audio files. Each participant in both interventions received a folder with information on each session.

Internet-based mindfulness-based cognitive therapy. The eMBCT was delivered individually and included weekly asynchronous written interaction with a therapist over e-mail. Patients were granted access to a secure Web site containing material for 8 weeks plus a silent day and an inbox. Each session included an introduction and daily meditation exercises with meditation audio files. Patients were asked to practice and fill out practice diaries on a daily basis. They were provided with (fictional) patients' descriptions to emphasize common experiences and clarify the use of the diaries. Patients were given written instructions after week 5 to prepare for their silent day at home. In the week of the silent day, patients were provided with a program similar to the MBCT silent day. At the end of the silent day, eMBCT patients wrote about their experiences in an essay. The therapist provided written feedback on the completed forms and the essay via the secured inbox on a prearranged day of the week. Having completed four or more sessions of MBCT was defined as a minimum adequate dose in both interventions.[22]

Treatment as usual. TAU consisted of all health care that patients usually received. Except for not participating in MBIs during the study period, there were no restrictions on health care utilization. Data on health care utilization were gathered using the Trimbos/iMTA questionnaire for Costs associated with Psychiatric illnesses.[23]

Therapists

Fourteen therapists participated: seven provided both interventions, two only provided MBCT, and five only provided eMBCT. All therapists fulfilled the criteria of the UK Mindfulness-Based Teacher Therapist Network Good Practice Guidelines for teaching MBIs.[24] Three full-day supervision meetings were held during the intervention phase of the trial. All face-to-face MBCT sessions were videotaped to evaluate therapist competency using the Mindfulness-Based Interventions-Teachers Assessment Criteria.[25] Therapist competency levels were determined by two independent therapists who evaluated two random sessions from each of the nine therapists providing face-to-face MBCT (who treated 80.8% of all patients receiving either intervention). Interrater reliability was .72. Of the nine therapists rated, four were considered proficient (n = 64 patients), three were considered competent (n = 64 patients), and two were considered beginner (n = 7 patients).

Measures

Primary outcome. Psychological distress was measured with the HADS, a 14-item self-report scale designed to assess anxiety and depression in medical outpatients.[26,27] It has good psychometric properties in the general medical population, including patients with cancer in palliative care.[28] The internal consistency in this sample was high (α = .87).

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Secondary outcomes. Psychiatric diagnosis was assessed by the Structured Clinical Interview for DSM-IV-TR Axis I Disorders.[29] The Structured Clinical Interview for DSM-IV-TR Axis I Disorders was administered by a trained interviewer who completed a Master in Behavioral Science degree (F.C.), supervised by either an experienced psychiatrist (E.B. or A.S.) or psychologist (M.v.d.L.). All interviews were audiotaped. Fear of cancer recurrence was assessed with the severity subscale of the Fear of Cancer Recurrence Inventory.[30,31] Rumination was measured by the rumination subscale of the Rumination and Reflection Questionnaire;[32] health-related quality of life was measured by the mental and physical scales of the Short-Form 12[33] using Dutch norm scores from a clinical sample;[34] mindfulness skills were measured by the Five Facet Mindfulness Questionnaire-Short Form;[35] and positive mental health was measured by the Mental Health Continuum-Short Form.[36] As a potential moderator, neuroticism was measured by the Neuroticism Extraversion Openness-Five Factor Inventory.[37] Further details of the measures used are included in the study protocol (Data Supplement).[21]

Sample Size

The sample size calculation was based on previous postintervention HADS scores of patients with cancer who received MBCT at the Helen Dowling Institute (mean, 10.6; standard deviation [SD], 6.4) compared with those who had not received it (mean, 14.8; SD, 8.1). With 90% power, 65 patients per condition were needed. Because of anticipated differential dropout rates among treatment arms, the recruitment target was 245 patients: 76 in each of the MBCT and TAU arms, and 93 in the eMBCT arm.

Randomization and Blinding

Once patients provided oral and written consent and completed the baseline assessment, they were randomly assigned to MBCT, eMBCT, or TAU by a computer-generated allocation sequence designed by an independent biostatistician. This custom software was accessed by one of the researchers (E.B.) via a study-specific Web site. Randomization was carried out with a fixed block size of 16 stratified for region and minimized for sex, cancer diagnosis (breast *v* other), and anticancer treatment intent (curative *v* palliative). After randomization, E.B. informed patients of their allocation by e-mail. E.B. planned and invited participants to the follow-up assessments; the standardized psychiatric interviews were conducted by F.C. and research assistants who were blinded to treatment allocation. Both E.B. and F.C. instructed patients not to mention their treatment condition at the beginning of each psychiatric interview.

Statistical Analysis

Statistical analyses were carried out using Statistical Package for the Social Sciences (SPSS) version 22 (SPSS, Chicago, IL). Differences among conditions in demographic and clinical variables were tested by χ^2 analysis and *t* tests. Continuous outcomes were analyzed with linear mixed modeling in a model with uncorrelated residual errors and random intercepts, including group allocation and its interaction with time and stratification (region) and minimization (sex, cancer diagnosis, anticancer treatment intent) variables as fixed factors. Because both MBCT and eMBCT were compared with TAU, the two-sided type I error rate was corrected to .025 for the two direct (MBCT and eMBCT) comparisons with TAU. All reported analyses used the intent-to-treat sample. Missing continuous outcomes were imputed with automatic multiple imputation on the basis of linear regression (20 iterations). The multiple imputation data set was considered the primary data set. Cohen's d effect sizes were calculated using postintervention means and baseline pooled SDs. These statistics are commonly used in psychological contexts to compare effect sizes across studies,[38] and in accordance with Cohen's guidelines, Cohens's d effect sizes were interpreted as small (0.2 to 0.5), medium (0.5 to 0.8), or large (> 0.8).[39]

In addition, the reliable change index (RCI) was calculated by dividing the observed difference score by the SE of measurement. Each participant was categorized as improved (RCI < −1.96), no change (−1.96 to 1.96), or deteriorated (RCI > 1.96).[40] Improvements in terms of psychiatric diagnosis and RCI were assessed using χ^2 analyses.

Exploratory moderation analyses of dropout were performed using logistic regression, including an interaction term between completer (yes/no) and possible moderators: sex, age, cancer diagnosis, anticancer treatment intent, psychiatric diagnosis, neuroticism, and therapist. Exploratory moderation analyses of the primary outcome were performed by including a three-way interaction term among condition, time, and possible moderators: sex, age, cancer diagnosis, anticancer treatment intent, psychiatric diagnosis, neuroticism, and therapist. First, moderators were assessed in two separate analyses of either intervention compared with TAU. Second, moderators were assessed in analyses of the two intervention conditions only.

RESULTS

Study Sample

In total, 532 patients were screened with the HADS (Fig 1), of whom 98 (18.4%) were excluded for scoring < 11. Of 434 patients who were contacted by telephone, 24 (5.5%) were excluded because of previous experience with mindfulness, 22 (5.1%) could not be contacted, and 95 (21.9%) declined participation because of possible traveling distance (n = 55; 12.7%); strong randomization preference (n = 12; 2.8%), of whom four had a preference for eMBCT and eight for in-person group MBCT; and scheduling difficulties (n = 11; 2.5%). Of the remaining 293 patients, another 10 (3.4%) could not be contacted, and 38 (13.0%) declined participation after the baseline assessment. There were no significant differences in mean HADS scores between the 133 decliners (mean, 20.4; SD, 5.6) and those who were randomly assigned (mean, 20.6; SD, 6.2). In total, 245 patients with cancer were randomly assigned to MBCT (n = 77), eMBCT (n = 90), or TAU (n = 78). The three conditions did not differ in terms of baseline demographic or clinical characteristics (Table 1). The number of months between baseline and postintervention assessments did not differ between MBCT (mean, 5.4; SD, 2.3) and eMBCT (mean, 5.9; SD, 1.8; $P = .13$), but was higher in both intervention conditions than in TAU (mean, 3.5; SD, 0.9; $P < .001$).

Seventy of 77 patients (90.9%) started MBCT, and 71 (92.2%) completed four or more sessions (mean, 7.9; SD, 1.3; Fig 1). Eighty-two of 90 patients (91.1%) started eMBCT and 71 completed four or more sessions (mean, 8.6; SD, 12). The amount of estimated daily minutes of mindfulness practice did not differ significantly between MBCT (n = 56; mean, 30.6; SD, 26.0) and eMBCT (n = 70; mean, 28.7; SD, 29.3; $P = .69$). Dropouts from the interventions were significantly higher in the eMBCT than in the MBCT group: $\chi^2(1, n = 167) = 3.92$ ($P = .047$). Nonresponse on the post-treatment assessment was substantial (16.9% in MBCT, 16.7% in eMBCT, and 10.3% in TAU) but did not differ significantly among conditions ($P = .41$). Nonresponders were more often female ($P = .033$) and had less education ($P = .037$) than responders.

Health Care Utilization

There were no significant differences in health care utilization between the intervention and TAU groups (Table 2), except for the proportion of patients receiving outpatient treatment (eg, chemotherapy), which was higher in the TAU group.

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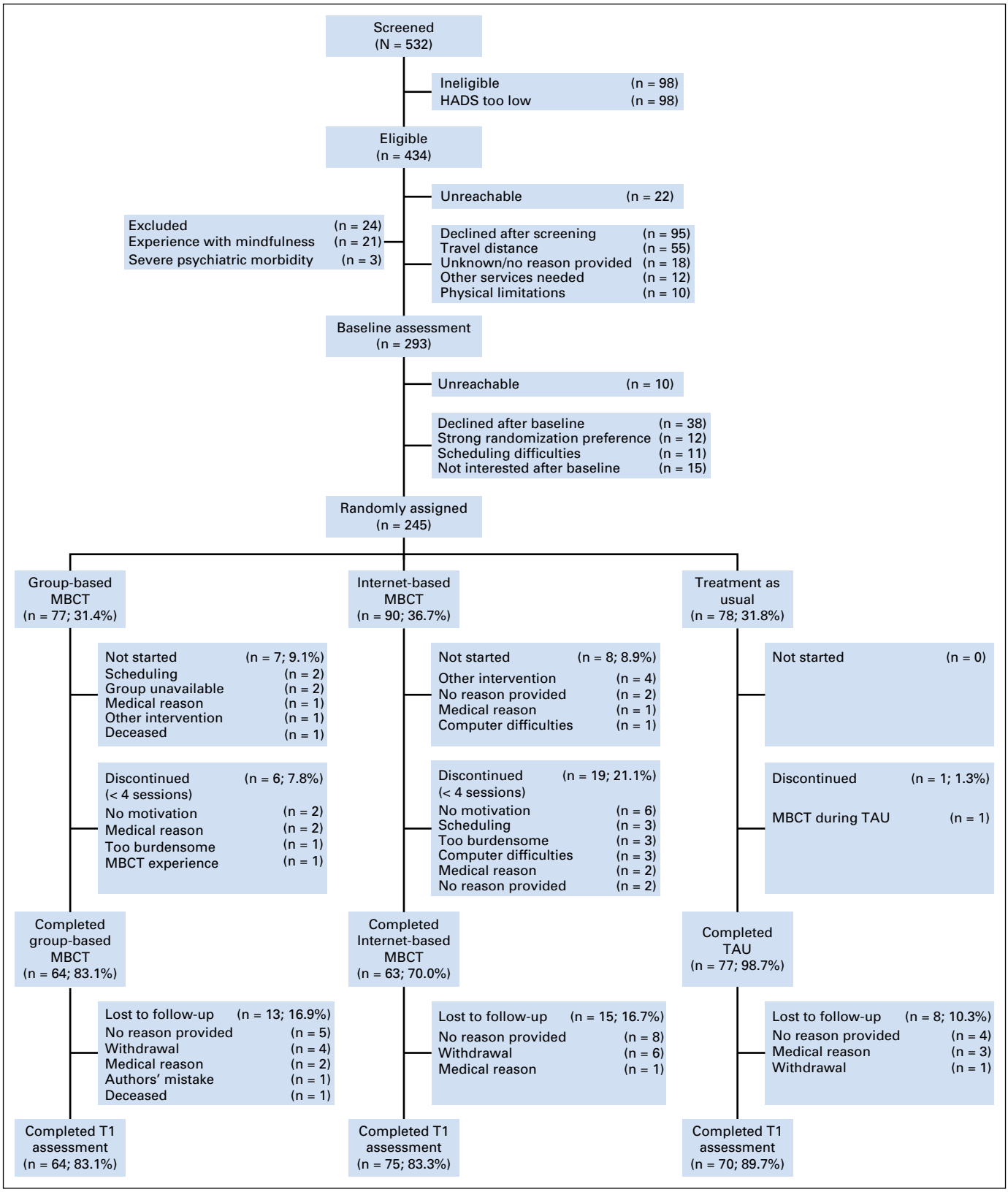

Fig 1. CONSORT diagram (n = 245). HADS, Hospital Anxiety and Depression Scale; MBCT, mindfulness-based cognitive therapy; TAU, treatment as usual.

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Table 1. Baseline Sociodemographic and Clinical Characteristics (n = 245)

Characteristic	All (n = 245)	MBCT (n = 77)	eMBCT (n = 90)	TAU (n = 78)	*P*
Sex					.912
Female	210 (85.7)	67 (87.0)	77 (85.6)	66 (84.6)	
Male	35 (14.3)	10 (13.0)	13 (14.4)	12 (15.4)	
Age (years)					.464
Mean	51.7	52.1	52.4	50.4	
SD	10.7	11.4	10.7	9.9	
Married/in a relationship					.491
Yes	202 (82.4)	65 (84.4)	76 (84.4)	61 (78.2)	
No	43 (17.6)	12 (15.6)	14 (15.6)	17 (21.8)	
Children					.314
Yes	169 (69.0)	48 (62.3)	65 (72.2)	56 (71.8)	
No	76 (31.0)	29 (37.7)	25 (27.8)	22 (28.2)	
Education					.451
High	166 (67.8)	54 (70.1)	56 (62.2)	56 (71.8)	
Middle	77 (31.4)	22 (28.6)	34 (37.8)	21(26.9)	
Low	2 (0.8)	1 (1.3)	0	1(1.3)	
Diagnosis					.724
Breast cancer	151 (61.6)	53 (68.8)	53 (58.9)	45 (57.7)	
Gynecologic cancer	18 (7.3)	2 (2.6)	9 (10.0)	7 (9.0)	
Prostate cancer	16 (6.5)	6 (7.8)	7 (7.8)	3 (3.8)	
Colon cancer	12 (4.9)	4 (5.2)	4 (4.4)	4 (5.1)	
Non-Hodgkin's lymphoma	11 (4.5)	1 (1.3)	3 (3.3)	7 (9.0)	
Skin cancer	5 (2.0)	1 (1.3)	3 (3.3)	1 (1.3)	
Thyroid cancer	4 (1.6)	1 (1.3)	1 (1.1)	2 (2.6)	
Bladder cancer	4 (1.6)	1 (1.3)	2 (2.2)	1 (1.3)	
Neuroendocrine tumor	4 (1.6)	1 (1.3)	2 (2.2)	1 (1.3)	
Other	20 (8.2)	7 (9.1)	6 (6.7)	7 (9.0)	
Years since diagnosis					.616
Mean	3.5	3.9	3.3	3.2	
SD	4.7	5.7	4.0	4.3	
Anticancer treatment intent					.472
Curative	206 (84.1)	68 (88.3)	74 (82.2)	64 (82.1)	
Palliative	39 (15.9)	9 (11.7)	16 (17.8)	14 (17.9)	
Current treatment					.694
None	133 (53.1)	43 (55.8)	49 (54.4)	41 (52.6)	
Hormone therapy	79 (32.2)	22 (28.6)	28 (31.1)	29 (37.2)	
Combination of treatments	12 (4.9)	4 (5.2)	4 (4.4)	4 (5.1)	
Immunotherapy	9 (3.7)	1 (1.3)	5 (5.6)	3 (3.8)	
Radiotherapy	8 (3.3)	5 (6.5)	3 (3.3)	0	
Chemotherapy	4 (1.6)	2 (2.6)	1 (1.1)	1 (1.3)	

NOTE. Data presented as No. (%).
Abbreviation: eMBCT, Internet-based mindful-based cognitive therapy; MBCT, mindfulness-based cognitive therapy; SD, standard deviation; TAU, treatment as usual.

Safety

A total of 21 severe adverse events unrelated to the intervention were reported in the MBCT (n = 6), eMBCT (n = 9), and TAU (n = 6) groups (Appendix Table A1, online only). One severe adverse event occurred during the study period: a patient died after being randomly assigned as a result of illness.

Intervention Outcomes

In between-group comparisons of both interventions compared with TAU, patients in the MBCT and eMBCT conditions reported significantly less psychological distress postintervention than did those receiving TAU, with small to medium effect sizes (Cohen's d, .45 and .71, respectively; Table 3; Fig 2). The proportion of patients demonstrating reliable improvement was significantly greater in MBCT than TAU (36% *v* 14%; $\chi^2[1, n = 134] = 8.44$; P = .004) and in eMBCT than TAU (37% v 14%; $\chi^2[1, n = 145] = 9.95$; P = .002). Improvement in rates of psychiatric diagnosis favored both interventions compared with TAU but were not statistically significant (MBCT: 32% v 16%; $\chi^2[1, n = 126] = 4.73$; P = .030; and eMBCT: 29% v 16%; $\chi^2[1, n = 138] = 3.15$; *P* = .076).

Compared with TAU, both MBCT and eMBCT significantly reduced fear of cancer recurrence (Cohen's d, .27 and .53, respectively), rumination (Cohen's d, .42 and .51, respectively), and improved mental health–related quality of life (Cohen's d, .59 and .67, respectively), but not physical health–related quality of life (Cohen's d, .35 and .24, respectively). They also resulted in better mindfulness skills (Cohen's d, .47 and .82, respectively) and increased positive mental health compared with TAU (Cohen's d, .12 and .44, respectively).

Moderation

Exploratory analyses yielded no significant moderation of intervention dropout or primary outcome in the analyses comparing both interventions with TAU separately (all *P*s > .05), except for neuroticism. In the analyses comparing either MBCT interventions with TAU, there was a significant interaction between neuroticism and intervention condition (MBCT *v* TAU *P* = .014; eMBCT *v* TAU *P* = .004). Patients scoring higher on neuroticism on baseline improved more on psychological distress in both intervention conditions than in TAU.

DISCUSSION

To our knowledge, this is the first study to simultaneously compare MBCT and eMBCT with TAU in a large sample of distressed heterogeneous patients with cancer. Both MBCT and eMBCT resulted in a statistically significant and clinically reliable reduction of psychological distress compared with TAU (Table 4). Both interventions demonstrated similar reductions of fear of cancer recurrence, rumination, and improvements in mental (but not physical) health–related quality of life, mindfulness skills, and positive mental health compared with TAU.

Our study confirms previous findings regarding the effectiveness of eMBIs for patients with cancer.[14,19] Although the group-based setting is considered important for MBIs,[41] this study suggests that individual guided eMBCT with limited teacher feedback is also effective, thus improving the accessibility of this intervention for patients with cancer. However, eMBCT did result in higher dropout rates than MBCT. Exploratory analyses did not yield any moderators of intervention dropout. Furthermore, qualitative research examining the reasons for dropout is critical to improve the efficacy of Web-based interventions.[42]

A strength of this study is the patient-centered nature of the recruitment across multiple regions because in previous research, we encountered difficulties with consecutive sampling of patients in hospital outpatient settings.[43] Other strengths are that the interventions followed strict protocols, they were delivered by qualified therapists, and therapist competency was rated by two

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Table 2. Health Care Utilization During the Intervention Period for MBCT, eMBCT and TAU Groups

	All (n = 198)		MBCT (n = 63)		eMBCT (n = 72)		TAU (n = 63)		
Utilization	No.	%	No.	%	No.	%	No.	%	*P**
Hospital outpatient consultation	153	77	45	71	61	85	47	75	.153
Hospital overnight	13	7	4	9	4	6	5	8	.853
Hospital outpatient treatment	36	18	6	10	12	17	18	29	.020
Hospital emergency department	7	4	1	1	3	3	3	4	.588
Mental health care†	62	31	18	29	24	33	20	32	.834
General practitioner	116	59	35	56	39	54	42	67	.285
Physical therapist	92	47	29	46	40	56	23	37	.086
Complementary care	56	28	21	33	20	28	15	34	.491

Abbreviations: eMBCT, Internet-based MBCT; MBCT, mindfulness-based cognitive therapy; TAU, treatment as usual.
*Pearson χ^2 test.
†Social worker, psychologist.

independent, experienced therapists. We systematically collected data on health care utilization during the study. The study used a broad array of outcome measures, including both observer-rated interviews and self-report questionnaires.

In addition to these strengths, the study has some limitations. The study was not powered to directly compare the two interventions or determine noninferiority of eMBCT to MBCT, because this would have required a larger sample size. As with other psycho-oncology research, the majority of the participants were middle-aged patients with breast cancer. Although this is in line with the characteristics of patients with cancer seeking psychosocial support,[44] this might limit generalizability to patients with other

Table 3. Mean Scores at Baseline and Postintervention (both listwise deletion and pooled multiple imputation scores are depicted) and Between-Group Differences for Primary and Secondary Outcome Measures

	Groups										Linear Mixed Modeling: Between-Group Differences							
	MBCT			eMBCT			TAU			*P**	TAU-MBCT				TAU-eMBCT			
Outcome Measure	No.	M	SD†	No.	Mean	SD†	No.	Mean	SD†	Overall	Est.	SE	*P*	ES	Est.	SE	*P*	ES
Primary																		
HADS																		
T0	77	18.81	6.70	90	17.24	7.07	78	17.04	5.79									
T1 original	64	13.25	6.33	75	11.87	6.16	70	16.37	6.50	< .001	4.65	1.00	< .001	0.50	4.63	.96	< .001	0.70
T1 imputed	77	13.69	0.78	90	11.88	0.69	78	16.48	0.78	< .001	4.56	1.02	< .001	0.45	4.81	.95	< .001	0.71
Secondary																		
FCRI severity																		
T0	77	21.49	6.55	90	21.20	5.80	77	21.13	7.28									
T1 original	64	18.05	6.49	75	17.28	7.33	68	20.66	7.10	< .001	2.27	0.86	.009	0.38	3.34	.82	< .001	0.51
T1 imputed	77	18.65	0.79	90	17.06	0.81	78	20.53	0.84	< .001	2.23	0.89	.013	0.27	3.52	.84	< .001	0.53
RRQ rumination																		
T0	77	44.04	7.96	90	43.09	8.17	77	42.69	8.56									
T1 original	64	37.61	8.16	75	36.81	8.90	68	41.65	8.85	< .001	4.87	1.14	< .001	0.49	4.85	1.10	< .001	0.58
T1 imputed	77	38.12	1.04	90	37.26	0.97	78	41.56	1.05	< .001	4.77	1.20	< .001	0.42	4.68	1.14	< .001	0.51
SF-12 Mental																		
T0	77	32.48	10.19	90	34.50	12.15	78	34.74	11.10									
T1 original	64	43.41	9.67	72	44.17	9.95	63	36.78	11.31	< .001	−8.89	2.01	< .001	0.62	−7.88	1.95	< .001	0.64
T1 imputed	77	42.71	1.23	90	44.25	1.21	78	36.42	0.95	< .001	−8.55	1.98	< .001	0.59	−8.07	1.92	< .001	0.67
SF-12 Physical																		
T0	77	46.06	8.88	90	45.62	10.25	78	45.40	8.24									
T1 original	64	48.24	8.45	72	48.19	10.51	63	45.24	9.77	.343	−2.14	1.61	.19	0.35	−1.91	1.57	.22	0.32
T1 imputed	77	48.43	1.11	90	47.60	1.20	78	45.40	1.21	>.05	−2.38	1.61	.14	0.35	−1.99	1.57	.21	0.24
FFMQ-SF total																		
T0	77	72.43	9.69	90	76.39	10.87	77	75.75	11.18									
T1 original	64	82.02	10.42	75	85.52	11.94	70	77.26	11.80	< .001	−8.03	1.76	< .001	0.45	−8.06	1.69	< .001	0.75
T1 imputed	77	81.61	1.29	90	85.75	1.33	78	76.73	1.41	< .001	−8.17	1.82	< .001	0.47	−8.35	1.70	< .001	0.82
MHC-SF total																		
T0	77	34.05	12.39	90	37.16	13.77	77	37.56	12.46									
T1 original	64	40.02	12.39	75	43.53	13.14	70	37.86	13.34	.001	−5.19	1.71	.003	0.17	−6.10	1.64	< .001	0.43
T1 imputed	77	38.85	1.51	90	43.13	1.46	78	37.36	1.59	< .005	−4.97	1.71	.004	0.12	−6.15	1.66	< .001	0.44

Abbreviations: ES, effect size; Est., estimate; FCRI, Fear of Cancer Recurrence Inventory; FFMQ, Five Facet Mindfulness Questionnaire-Short Form; HADS, Hospital Anxiety and Depression Scale; eMBCT, Internet-based mindful-based cognitive therapy; MBCT, mindfulness-based cognitive therapy; MHC-SF, Mental Health Continuum-Short Form; RRQ, Rumination and Reflection Questionnaire; SD, standard deviation; SF-12, Short Form-12; TAU, treatment as usual.
*Because both MBCT and eMBCT were compared with TAU, the two-sided type I error rate was corrected to .025.
†SE for imputed means.

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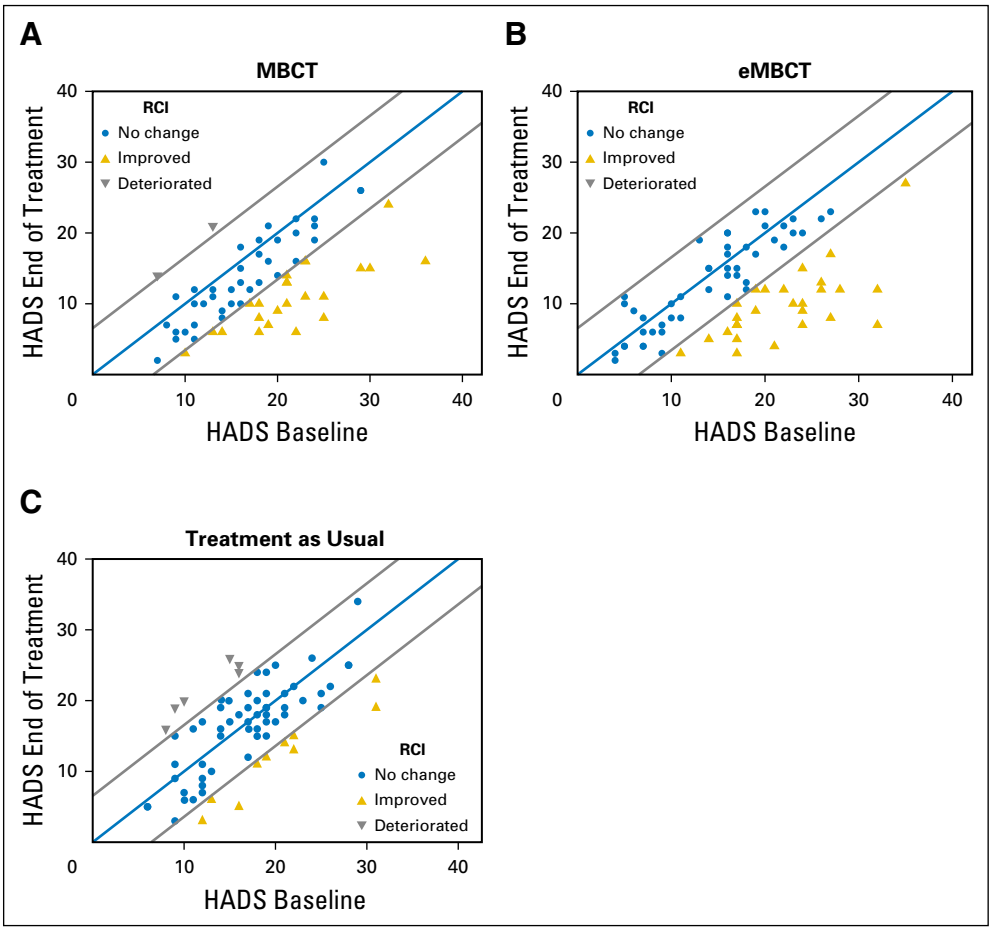

Fig 2. Change in Hospital Anxiety and Depression Scale (HADS) scores between baseline and postintervention for (A) mindfulness-based cognitive therapy (MBCT), (B) Internet-based mindful-based cognitive therapy (eMBCT), and (C) treatment as usual (TAU) groups. The blue diagonal line represents no change in HADS between baseline and postintervention, and the gray upper and lower lines represent the upper (above indicates deteriorated) and lower (below indicates improved) bounds of the 95% CI of the Jacobson-Truax reliable change index (RCI).

types of cancer. Because one inclusion criterion was the ability and willingness to attend both MBCT and eMBCT, the sampling frame for the current study was probably not representative of patients who would prefer eMBCT in clinical practice. Because treatment preference is often positively correlated with treatment outcome,[45] we would expect that this RCT underestimated rather than overestimated the effects of eMBCT.

In terms of research implications, long-term results should be gathered to examine the stability of effects. In addition, data on cost-utility of MBIs in patients with cancer should be collected.[46] Internet interventions do not involve the costs of transportation, traveling time, space, equipment, cleaning, and other overhead expenses and thus could be more cost effective. Possible mediators of the effect, such as mindfulness skills or rumination, should be further investigated.[47,48] Moreover, mediation analyses could also examine possible differences in adherence in both MBCT and eMBCT.

In terms of clinical implications, implementation of eMBCT could make MBIs more accessible for patients with cancer without having to compromise intervention efficacy. However, intervention dropout could possibly be improved by the delivery mode of eMBIs.[49] Qualitative work demonstrates that aspects such as the individual nature and the asynchronous interaction of the eMBCT used in this study are helpful for some patients.[50] Future studies should assess how different eMBCT designs (eg, blended designs

Table 4. Clinically Significant Improvement Measured by Jacobson-Truax Reliable Change Index on HADS and Psychiatric Diagnosis Between Baseline and Postintervention for MBCT, eMBCT, and TAU Groups

	Reliable Change Index (n = 209)								Psychiatric Diagnosis (n = 202)							
	MBCT (n = 64)			eMBCT (n = 75)			TAU (n = 70)		MBCT (n = 64)			eMBCT (n = 76)			TAU (n = 62)	
Improvement	No.	%	*P**	No.	%	*P**	No.	%	No.	%	*P**	No.	%	*P**	No.	%
Improved	23	36	.004	28	37	.002	10	14	21	33	.030	22	29	.076	10	16
No change	39	61		47	63		54	77	34	67		50	66		49	79
Deteriorated	2	3	.184	0	0	.010	6	9	0	0	.075	4	5	.910	3	5

Abbreviations: eMBCT, Internet-based MBCT; HADS, Hospital Anxiety and Depression Scale; MBCT, mindfulness-based cognitive therapy; TAU, treatment as usual.
*Between group χ^2 tests for the respective condition compared with TAU.

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combining the advantages of face-to-face and Internet-based elements)[51] could further improve intervention accessibility, adherence, and effectiveness.[50]

AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Disclosures provided by the authors are available with this article at jco.org.

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Support

Supported by Pink Ribbon (2012.WO14.C153). L.C. holds the Enbridge Research Chair in Psychosocial Oncology, co-funded by the Canadian Cancer Society Albert/Northwest Territories Division and the Alberta Cancer Foundation.

Prior Presentation

Presented at the 14th International Congress of Behavioral Medicine, Melbourne, Australia, December 7-9, 2016; and the 19th World Congress of International Psycho-Oncology and Psychosocial Academy, Berlin, Germany, August 14-18, 2017.

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Face-to-Face and Internet-Based Mindfulness-Based Cognitive Therapy Compared With Treatment as Usual in Reducing Psychological Distress in Patients With Cancer: A Multicenter Randomized Controlled Trial

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No relationship to disclose

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Acknowledgment

We are grateful to the patients for their participation in this trial and to physicians and therapists from Radboud University Medical Centre, Nijmegen; Helen Dowling Institute, Bilthoven; De Vruchtenburg, Leiden/Rotterdam; Ingeborg Douwes Centrum, Amsterdam; Het Behouden Huys, Haren; and Jeroen Bosch Ziekenhuis, Den Bosch, the Netherlands, for referring patients to the trial. We would like to thank Heidi Willemse, Eva Witteveen, Merel Brands, and David Huijts for their help in data collection; and Ellen Jansen, Rinie van den Boogaart, Coen Völker, Joyce Vermeer, Bert Vedder, Ineke Vogel, Mira Reus, Lot Heijke, Maria van Balen, Annetje Brunner, Maya Schroevers, Stephanie Verhoeven, and Janine Mutsaers for providing the online and group mindfulness-based cognitive therapy. We thank Caroline Hoffman for her contribution to the supervision of the therapists.

Appendix

Table A1. Adverse Events Reported per Condition

Participant	MBCT (n = 9)	eMBCT (n = 6)	TAU (n = 9)
Intervention completer	Pneumonia (n = 1) Cancer recurrence (n = 1) Questionnaires too burdensome (n = 4)	Questionnaires too burdensome (n = 2) Needed additional psychological help (n = 1)	Illness progression (n = 3) Questionnaires too burdensome (n = 3) Needed additional psychological help (n = 2) Reported high distress (n = 1)
Intervention dropout	Surgery (n = 1) Deceased (n = 1) Unspecified medical reason (n = 1)	Illness progression (n = 1) Unspecified medical reason (n = 2)	

Abbreviations: eMBCT, Internet-based MBCT; MBCT, mindfulness-based cognitive therapy; TAU, treatment as usual.

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