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Nurse-Delivered Brief Behavioral Treatment for Insomnia in Lung Cancer Survivors: A Pilot RCT

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Abstract

Objective/Background—Insomnia occurs in 50 to 80% of lung cancer survivors. Cognitive behavioral therapy is the standard treatment for insomnia (CBTI); however, treatment length and lack of psychologists trained in CBTI limits access. Brief Behavioral Treatment for Insomnia (BBTI), a nurse-delivered modified CBTI, is proposed. This feasibility pilot study sought to compare the BBTI intervention to attention control Healthy Eating Program (HEP) for insomnia in lung cancer survivors.

Participants—The participants comprised adults, 21 years of age or older with insomnia and stage I/II non-small cell lung cancer, more than 6 weeks from surgery and living in Western NY.

Methods—Participants (n=40) were randomly assigned to an experimental (BBTI) or attention control condition (Healthy Eating Program). Thirty participants completed the study.

Results—Participants were 66 years of age (± 7.6 ; range 53–82), 40% (n=16) male, 87.5% (n=35) Caucasian, 50% (n=20) married, BMI 27.7 (± 5.8), and 12% (n=5) never smokers. Baseline sleep diary sleep efficiency, ISI and other baseline covariates were balanced between the groups. Sleep efficiency improved 85% in BBTI group ($p=.02$), but not in HEP control group ($p=1.00$). Mean ISI for BBTI and attention control were 6.40 ± 4.98 and 14.10 ± 4.48 ($p=.001$) respectively. In addition, BBTI group mean total FACT-L score improved by 6.66 points from baseline while HEP group score worsened ($p=0.049$).

Conclusions—BBTI is a practical, evidence-based, clinically relevant intervention that improved sleep and quality of life in lung cancer survivors with insomnia. Additional research to evaluate efficacy, duration, and implementation strategies are essential.

Keywords

older adults; insomnia; cancer survivors; behavioral therapy

INTRODUCTION

Insomnia, defined as difficulty initiating and maintaining sleep, and/or early morning awakening, and/or dissatisfaction with sleep, is common in patients with cancer (Association, 2013; Savard, Ivers, Villa, Caplette-Gingras, & Morin, 2011). Rates of insomnia in patients with cancer range from 19–40%, while the prevalence of insomnia in lung cancer survivors ranges from over 50% - 80%, persisting an average of eight years after diagnosis (Gooneratne et al., 2007; Ilonen et al., 2010; J. A. Roscoe et al., 2007). Lung cancer patients had the highest frequency of using sleeping pills (40%), being overly sleepy (39.5%) and sleeping more than usual (34%) compared to other patients with solid tumors (Davidson, MacLean, Brundage, & Schulze, 2002). Lung cancer survivors often have a smoking history, chronic obstructive pulmonary disease (COPD), and side effects of lung cancer treatment. Collectively these may impair pulmonary function resulting in hyperarousal from pain, cough and dyspnea (Sanders et al., 2003) and lead to exacerbation of insomnia in lung cancer survivors (J. K. Roscoe, ME.; Matteson-Rusby, SE.; Palesh, OG; Ryan, JL.; Kohli, S.; Perlis, ML. and Morrow, GR. , 2007). To date, little research exists on strategies to effectively reduce insomnia in lung cancer survivors, especially in the application of cognitive behavioral therapy for insomnia (CBTI).

Cognitive Behavioral Therapy for Insomnia (CBTI) is a well-established treatment in adults with primary insomnia and in cancer survivors (Johnson et al., 2016). However, the majority of clinical trials using behavioral therapies were conducted in women with breast cancer (Johnson et al., 2016). Cancer patients can benefit from CBTI as an alternative treatment to pharmaceuticals with fewer side effects (Buysse, 2000; Geiger-Brown et al., 2015). Despite being a well-established treatment for insomnia, the dose/duration of CBTI is in question (Buysse, 2000). Research on the efficacy of CBTI indicate a treatment duration ranging from 4 to 14 weeks for patients with primary insomnia (Edinger, 2005). The high cost of CBTI and critical shortage of specially trained psychologists requires alternative care delivery models. Efforts to improve the cost-effectiveness of CBTI with group sessions (Redeker et al., 2017) and shorter treatment durations (Troxel, Germain, & Buysse, 2012) have begun.

Brief Behavioral Treatment for Insomnia (BBTI) proposes a concise version of the traditional CBTI with similar impact on insomnia (Shimodera, 2014). BBTI shares the same core principles with CBTI and was modeled to be disseminated by nurses and other licensed healthcare professionals, thus reducing clinical challenges associated with the CBTI version (Troxel et al., 2012). Nurses comprise the largest segment of the healthcare workforce and have the most continuous interaction with patients in the clinical setting. As such, they are uniquely qualified and positioned to deliver BBTI.

BBTI content is linked to the Two Process Model of Sleep Regulation (Borbely, 1982). The developers of the treatment strategy have published a session by session guide and a workbook with guidelines to facilitate the training and delivery of BBTI (Troxel et al., 2012). This treatment model has been used successfully in elderly patients with significant improvement in sleep quality and quality of life (Buysse et al., 2011). However, broad dissemination into comorbid insomnia has not been achieved (Savard, Villa, Simard, Ivers, & Morin, 2011). Lung cancer survivors are often underrepresented in insomnia management studies despite their prevalence, persistent and burdensome insomnia symptoms (Chen, Yu, & Yang, 2008; Davidson et al., 2002; Dean et al., 2013; Degner & Sloan, 1995; Gooneratne et al., 2007).

The aim of this pilot feasibility study was to determine whether the BBTI intervention could successfully be carried out and assess the its impact on sleep diary sleep efficiency and secondarily on Insomnia Severity Index and quality of life variables compared to an attention control for lung cancer survivors with complex comorbid insomnia. It was hypothesized that the group receiving BBTI would show an improved sleep efficiency relative to the attention control group.

METHODS

Design

Institutional Review Board approval was obtained from the University at Buffalo, Veterans Administration Western New York Health Systems and Roswell Park Comprehensive Cancer Center before pilot RCT study initiation. Following informed consent and baseline data assessment, patients were randomized to experimental (BBTI) or control (HEP) interventions.

Sample and Setting

Participants were recruited from the Western New York region, specifically from a comprehensive cancer center and a Veterans Affairs medical center. Inclusion criteria involved Insomnia Severity Index (ISI) score >7 ; sleep complaint duration >3 months; pathologically confirmed stage I/II non-small cell lung cancer; 6 weeks from surgical tumor removal; able to complete data collection instruments independently; and 21 years of age. Participants with insomnia already using continuous positive airway pressure (CPAP) effectively (e.g. >4 -hours) for sleep apnea were included. Exclusion criteria included medical or psychiatric instability and untreated pre-existing sleep disorders as assessed by Sleep Disorders Symptom Checklist (Klingman, Jungquist, & Perlis, 2017). Sleep disordered breathing (Apnea Hypopnea Index >15) was additionally screened for by overnight ApneaLink Plus.

Measures

Demographic and clinical data collected included age, gender, race/ethnicity, marital status, and body mass index. Medical information was composed of cancer type, stage, post-surgery treatments, and substance use history.

The primary outcome variable was the 14-day average of the sleep diary sleep efficiency. Additional secondary outcome variables were: Insomnia Severity Index (ISI), Functional Assessment of Cancer Therapy-Lung Scale (FACT-L), Dysfunctional Beliefs and Attitudes about Sleep Survey (DBAS); Hospital Anxiety and Depression Scale (HADS); Pittsburgh Sleep Quality Index (PSQI); Epworth Sleepiness Scale (ESS); Profile of Mood States-Short Form (POMS-SF); and Patient Evaluation Question. Table 1 includes the psychometric properties of these measures.

Experimental and Attention Control Interventions

The BBTI (experiment) intervention began with the manualized version developed for primary care practices and based on the core principles that are fundamental to other empirically supported behavioral treatments for insomnia, including CBTI (Troxel et al., 2012). The authors of the manualized version sought to emphasize the sleep behavior changes and linked them to a physiological model of sleep regulation (Achermann & Borbely, 2003). A workbook with details on sleep hygiene practices for patients with treatment rationale and plans for sleep behavior changes that included 4-rules for better sleep (Troxel et al., 2012) was included. Slight additions to the BBTI manual included adding content on the stages of sleep and figures to enhance understanding of the biological clock noting the influences of melatonin and cortisol.

The attention (control) intervention was the Healthy Eating Program (HEP) designed by and implemented by nursing graduate students (MK & CW). They used the 4-rules for better sleep provided by the BBTI program as a model to develop the PASS program, where the acronym stands for Pay attention to what you are eating, Advanced planning for healthy eating, Substitutions with healthy choices, Small changes for success. These principles were used to create a 45-minute educational session to mirror the BBTI experimental condition for time and attention. Content included education about the impact of nutrition on sleep (i.e. eating too much or too little), general rules for healthy eating and specific suggestions to ensure healthy eating with the PASS program.

Experimental and Control Training Procedures

Nurse interventionists consisted of Baccalaureate (n=1) and Master's (n=3) prepared registered nurses pursuing graduate degrees. Training of nurses to deliver the interventions included reviewing content from the manualized BBTI and HEP, role-playing, videotaping content delivery and working with challenging cases. Treatment fidelity was determined by audio recording sessions, which were then reviewed by the PI and Co-I (CJ) for completeness. Weekly supervision and feedback provided to nurse interventionists by PI and Co-I revealed no deviation from either the treatment or attention control protocols.

Procedure

Recruitment occurred during follow up appointments at participants' clinics. Following informed consent, participants completed a home sleep test to screen for sleep disordered breathing (SDB). Following a negative screen, participants completed two weeks of baseline assessments including self-report sleep surveys, 14-days of sleep diaries and actigraphy. Participants were randomized to either BBTI or attention-control condition each consisting

of four weekly sessions (2-in person and 2-via telephone) with a nurse interventionist, but not informed of their assigned condition until the scheduled meeting with the nurse interventionist. Both groups received workbooks that included an outline of their assigned intervention content. At the end of the nurse interventionist meeting, participants in the experimental condition reviewed their sleep diary data with the nurse interventionist and negotiated a bedtime and wake-time schedule. Both groups received sleep diaries, but the control group had added questions regarding their adherence to the PASS program in their sleep diaries. Both groups negotiated timing for the planned follow up phone calls to assess adherence and review progress and challenges. After the intervention, two-follow up phone calls (one-week apart) were conducted, with average call duration of 24.9 minutes (time 1) to 26.5 minutes (time 2). Baseline data collection instruments were repeated at week five.

Data Analysis

All participants who completed baseline measures and were randomized to treatment were included in the analyses. Subjects were analyzed according to the intention-to-treat (ITT) principle, i.e. according to their randomized assignment irrespective of the treatment actually received (Piantadosi, 2005). Data were more likely to be missing-completely-at random (Allison, 2002) justified by the reasons participants gave for dropping out, presented in the Results section.

Descriptive statistics including frequencies and relative frequencies were computed for all categorical variables. Numeric variables were summarized using descriptive statistics involving means, standard deviations and ranges. The primary outcome was Sleep Efficiency greater than 85. The dichotomous variable SE85 was coded 1 for Sleep Efficiency ≥ 85 and 0 otherwise. Improvement in SE85+ was coded 1 if the baseline SE85 was 0 and the post-treatment value was 1; otherwise the SE85+ was coded 0. SE85+ was compared between the experimental and control groups using the z-test of proportions. Because the hypothesis was directional, a one-tailed test was used. Changes in SE85 from baseline to post-treatment within each group were assessed by McNemar's test.

Exploratory analyses of secondary outcome measures of daily, weekly and monthly insomnia severity, sleep quality, beliefs about sleep, mood and quality of life were undertaken, using ANCOVA while controlling for baseline scores. No adjustments for multiple testing were undertaken.

RESULTS

Subjects

Among 44 participants recruited, four were immediately excluded for referral to sleep apnea treatment, 40 completed baseline assessments, and 30 participants completed follow-up assessments. Reasons for early withdrawal: too busy with family ($n=2$), nervous about wearing equipment during sleep ($n=1$), non-cancer medical complications ($n=2$), cancer-related medical complications ($n=1$), death ($n=1$) and lost to follow up ($n=3$). The reasons for withdrawal were unrelated to insomnia outcomes, thereby justifying the assumption that missingness was completely at random and leaving the study unbiased. Early withdrawals

came equally from the experimental (n=5) and attention control (n=5) group. Demographics of the randomized sample (n=40): 66 years of age (± 7.7 ; range 53–82), 40% (n=16) male, 87.5% (n=35) Caucasian, 50% (n=20) married, BMI 27.7 (± 5.8). Disease-treatment characteristics included 80% (n=32) adenocarcinoma, 60% (n=24) stage 1A, and 90% (n=36) lobectomy. There were 5/40 (12.5%) never smokers included in this sample.

Among the 30 participants that completed the study, the average age was 65 + 7.5, 63% (n=19) were female, 90% (n=27) Caucasian, 80% (n=24) stage I disease and 63% (n=19) had adenocarcinoma. Average time since diagnosis was 8 months $\pm$ 4 months. BMI was 27.71 $\pm$ 5.27. There was no observed assignment imbalance between the groups according to demographic, disease or treatment variables at baseline (Table 2).

PRIMARY OUTCOME

SE85+

The hypothesis was that participants in the BBTI intervention would show a significant increase in SE85+ relative to the HEP control. The control group yielded an SE85+ of 1 out of 11 (9%) versus 7 of 14 (50%) in the experimental group ($p = .04$, one-tailed). There was essentially no change from baseline to post-treatment in the control group ($p = 1.00$) versus a positive change in the experimental group ($p = .02$).

SECONDARY OUTCOMES

Tables 3 and 4 present the secondary outcomes with post-treatment comparisons. Except for two measures, to be discussed, none of the secondary measures showed any differences between the two groups. In particular, the Sleep Efficiency scale showed no differences in contrast to its dichotomized version SE85.

Insomnia Severity Index

Mean ISI scores were significantly reduced in the BBTI group compared to the HEP group (6.9 vs 15.1, $p < .001$). Sixty-eight percent (n=11) of BBTI patients, as opposed to 21% (n=3) of HEP patients, had an ISI change score ≤ 6 ($p = .03$).

FACT-L

Participants in the BBTI intervention showed a decrease in mean FACT-L scores relative to the HEP control (74.7 vs 90.7, $p < .049$). The BBTI intervention showed improvement (increase) whereas the HEP control showed worsening (decrease) of the mean FACT-L.

Feasibility

Delivery of the interventions occurred in a conference room located near the ambulatory clinics where the BBTI session lasted an average of 46 minutes and HEP took, on average, 52 minutes (see Table 5). All intervention components were provided in the first session. One participant randomized to BBTI and one participant randomized to HEP could not attend the first session or participate in follow up phone calls, but did complete post intervention assessments.

Acceptability

Participants were asked to complete the Patient Evaluation Question at week 5, the final visit. The data collector who was not involved in intervention delivery provided the question to the participant. Twenty-two of the participants, 11 from each group, completed the Patient Evaluation Question. All but one participant in the BBTI group rated the intervention as strongly agree or agree that other patients would benefit from the intervention. While all but two participants in the HEP endorsed their program.

Study Completion Rate

Although a number of participants dropped out (n=10), 15/16 received the allocated BBTI and 13/14 received the assigned HEP intervention (Table 6). Eleven participants in each group completed the 1st follow up phone call, while eight in BBTI group and 10 in the HEP group completed the 2nd call.

Discussion

This pilot study sought to determine feasibility and preliminary effects of BBTI compared to attention control in lung cancer survivors with insomnia. Pre-post changes in sleep diary sleep efficiency (primary outcome), insomnia severity and quality of life (secondary outcomes) were assessed across two randomly assigned groups: BBTI (n=16) and HEP attention control (n=14). The BBTI intervention improved Sleep Efficiency 85 in the treatment group but not in the control. Among the secondary outcomes, significant improvements were noted in the ISI and the FACT-L (QOL) relative to the HEP intervention.

Consistent with our hypothesis, we observed significant group differences in sleep diary SE85+ immediately following BBTI. These preliminary results are in agreement with previous research where SE improvement has been reported in older adults with chronic insomnia (Buysse et al., 2011; Germain, Shear, Hall, & Buysse, 2007) and treatment resistant insomnia (Wang, Wei, Wu, Zhong, & Li, 2016). Given these strong preliminary findings, a fully powered RCT is warranted in cancer survivors.

Secondary findings from this study are consistent with those of others who have reported improvement in ISI using group BBTI in cancer survivors (Zhou, Partridge, Syrjala, Michaud, & Recklitis, 2017), and individual BBTI in treatment resistant insomnia (Wang et al., 2016) persons living with HIV (Buchanan et al., 2018) and military veterans (Germain et al., 2014). Wang et al. (2016) most closely aligned with our RCT using Troxel et al. (2012) a similar intervention approach, but used a sleep hygiene attention control. Indeed, Wang et al. (2016) reported a mean 4.77 group difference in perceived ISI at post-intervention where we reported a mean 4.37 decline. Research suggests that a 6-point decline on the ISI is recommended to represent a clinically meaningful improvement in primary insomnia (Yang, Morin, Schaefer, & Wallenstein, 2009). While not our entire sample achieved this level of decline in ISI, 68% in the BBTI and 21% in the HEP group improved.

Quality of life is an important outcome variable used extensively in cancer clinical trials (Basch et al., 2015). The BBTI group reported greater improvement in mean QOL score while the HEP group's QOL score declined post treatment. BBTI group mean QOL score

improved by 6.66 points which is more than twice the recommended clinically meaningful change (Cella et al., 2002). Previous research using BBTI lacked QOL measures in cancer and non-cancer samples (Buchanan et al., 2018; Wang et al., 2016; Zhou, Partridge, & Recklitis, 2017). Previous studies using CBTI and QOL measures reported mixed results. Significant improvements in QOL were reported by some (Espie et al., 2008; Peoples et al., 2017; Savard et al., 2005) versus improvement in CBT-I and the control condition using sleep hygiene (Dirksen & Epstein, 2008; Savard, Ivers, Savard, & Morin, 2014), while other studies reported no change in QOL (Matthews et al., 2014; Ritterband et al., 2012).

Both groups revealed DBAS mean scores that were higher than the mean level (3.8) reported in the validity analysis to discriminate those with insomnia from good sleepers (Carney et al., 2010). The clinically significant levels of unhelpful beliefs about sleep improved more in the BBTI group than the attention controls, albeit not significantly. Research involving BBTI and DBAS in patients with cancer for comparison were not found. However, one study involving treatment resistant insomnia revealed higher levels of DBAS at baseline in their BBTI (5.90) and control group (5.59) (Wang et al., 2016).

Fatigue, daytime sleepiness and mood mean scores were not significantly different between groups. Since relatively low scores of these variables were reported at baseline in both groups, there was little opportunity for scores to improve from treatment (Matthews et al., 2014).

In 2011, the initial BBTI efficacy study was conducted in older adults with insomnia (Buysse et al., 2011). Since then, six studies using BBTI to treat insomnia have been published and reviewed, with sample sizes ranging from 10–79 participants (Gunn, Tutek, & Buysse, 2019). Previous research suggests that 58–84% of participants completed the BBTI intervention consistent with our findings (Germain et al., 2007; McCrae, Bramoweth, Williams, Roth, & Mosti, 2014; Zhou, Vrooman, Manley, Crabtree, & Recklitis, 2017).

Unexpected findings revealed that more than a quarter of the recruited sample (n=12) required referral for further evaluation of OSA and/or nocturnal hypoxia. While insomnia and OSA are each distinct sleep disorders, increasing evidence suggests that they often co-occur (Luyster, Buysse, & Strollo, 2010; Y. Zhang et al., 2019). Hypoxia is linked to treatment resistance, cell proliferation, and metastatic potential, all contributing to a poor prognosis (Vaupel & Mayer, 2016). Tumor hypoxia reportedly enhances non-small cell lung cancer (NSCLC) metastasis by promoting macrophage polarization (J. Zhang et al., 2014). Hypoxia is also associated with tumor malignancy in a mouse model of sleep apnea (Almendros et al., 2014). Additionally, metastatic spread of lung cancer is associated with impaired quality of life and shortened survival rates (Oyewumi, Alazizi, Wehrung, Manochakian, & Safadi, 2014). This unexpected finding of hypoxia in postoperative lung cancer survivors may influence future clinical management and health care policy. Preliminary study findings support routine overnight *cumulative* screening for sleep apnea and nighttime oxygenation in postoperative stage I/II NSCLC survivors, as a potential clinical practice change.

This pilot RCT with attention control is not without limitations. Its internal validity is limited by its lack of power. Its generalizability is limited by its homogeneous sample from the Western New York region and by 25% attrition. Future studies will require larger and more heterogeneous samples. Efficacy was limited to immediate pre-post changes. Future studies in oncology are needed to determine long-term durability of BBTI. Future recruitment and retention may be enhanced by gaining support from and involving the clinical staff in the intervention and educating clinical staff on the importance of sleep to patient outcomes.

This feasibility pilot study supports BBTI as efficacious and successfully implemented in a small sample of lung cancer survivors by nurses in an oncology ambulatory setting. Previous research utilizing nurses to deliver a behavioral intervention to improve sleep in clinical settings has been reported (Berger, Treat Marunda, & Agrawal, 2009; Espie, 2007; Espie et al., 2008; Matthews, Schmiede, Cook, Berger, & Aloia, 2012). The interdisciplinary practice of sleep medicine provides an opportunity for nurses and other clinicians to enhance the widespread dissemination of BBTI to reduce the disease burden of insomnia and improve well-being.

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Table 1.

Psychometric Property of Instruments Measuring Main Outcome Variables

Variable	Instrument	Scoring Scheme	Validity and Reliability
Subjective sleep patterns	Sleep Diary (SD)	9-items that include assessments leading to sleep onset latency, WASO, TST, sleep efficiency and 5 point rating of sleep quality from very poor to very good.	Validity, clinical utility and usability. (Carney et al, 2012; Maich et al., 2018)
Insomnia	Insomnia Severity Index (ISI)	7-item self-report measure of insomnia symptoms; scores range from 0–28, and scores 15 are associated with clinical insomnia, while scores between 8–14 are associated with sub-threshold insomnia	Internal consistency (0.74–0.88) (Bastien et al., 2001)
Sleep quality	Pittsburgh Sleep Quality Index (PSQI)	19 Items with varying response categories, including forced-choice Likert-type subscales 0–3, culminating in a global score: 5 (good sleep), >5 (poor sleep). Maximum score=21.	Internal consistency (0.58–0.81) (Buysee et al., 1989)
Beliefs about sleep	Dysfunctional Beliefs and Attitudes About Sleep (DBAS)	30-item 0–10-point numeric scale; higher scores reflect higher dysfunctional beliefs and attitudes about sleep	Internal consistency and stability (Morin et al., 2007)
Daytime Sleepiness	Epworth Sleepiness Scale (ESS)	8 Likert-type items, to determine the likelihood of dozing off or falling asleep in a variety of situations: 0 (no chance of dozing) to 3 (high chance of dozing). Summary scores >10 consistent with daytime sleepiness. Maximum score=24.	Internal consistency (0.59–0.85) (Johns, 1991)
Fatigue	Profile of Mood States-Short Form (POMS-SF)	37-item, 0 (not at all) to 4 (extremely) scores range from 0–148 with six subscales to detect anxiety, depression, anger, vigor, fatigue and confusion.	Internal consistency (0.78–0.91) (Baker et al., 2002)
Anxiety and Depression	Hospital Anxiety Depression Scale (HADS)	14-item Likert-type scale ranging from 0 (never) to 3 (most of the time) scores range from 0 to 21 for anxiety or depression. A score higher than a 7 on either HADS subscale is considered to be clinically significant.	Comparing HADS with structured clinical diagnostic interviews revealed good predictive value & utility in patients with advanced cancer (Hopwood & Stephens, 2000; Snaith, 2003)
Quality of Life	Functional Assessment of Cancer Therapy-Lung Scale (FACT-L)	36-item self-report instrument consisting of 27-items from the FACT-General (FACT-G) and the 9-item Lung Cancer Subscale (LCS) (2 of 9 items not included in the total score), ratings of 0–4 on a Likert scale. Maximum score=136.	Internal consistency 0.56–0.89 (Butt et al., 2005)
Acceptability	Patient Evaluation Question	Rating of statement on a Likert scale (Strongly agree, agree, undecided, disagree, strongly disagree, strongly disagree): <i>Other participants with insomnia would benefit from this program.</i>	

Note. OSA=obstructive sleep apnea; RLS=restless legs syndrome; WASO=wake after sleep onset; TST=total sleep time

Table 2.

Demographics and Clinical Characteristics of the Participants

Demographic or Clinical Characteristics	Total Sample (n=30)		Control (n = 14)		Experimental (n = 16)	
	No	(%)	No	(%)	No	(%)
Age	65.73 ± 7.52		65.86 ± 8.08		65.63 ± 7.26	
Gender						
Female	19 (63)		9 (64)		10 (62.5)	
Male	11 (37)		5 (36)		6 (37.5)	
Race/Ethnicity						
African American	3 (10)		0 (0)		3 (18.8)	
Caucasian	27 (90)		14 (100)		13 (81.2)	
Cancer Stage						
Stage I/II	23/7		12/2		12/3	
Required chemotherapy	8 (27)		2 (14)		6 (38)	
BMI	27.74 ± 5.15		27.34 ± 5.88		28.09 ± 4.66	

Note. BMI = body mass index

Table3.

Subjective Sleep Measures

Measurement	Control (<i>n</i> = 14)		Experimental (<i>n</i> = 16)		<i>p</i> value
	Mean	S.D.	Mean	S.D.	
Insomnia Severity Index (ISI)					
Baseline	14.79	4.79	11.31	5.36	0.001
Follow-up	15.07	4.42	6.94	5.27	
	Control (<i>n</i> = 11)		Experimental (<i>n</i> = 14)		
SD-Sleep Opportunity					
Baseline	502.45	66.05	525.45	80.40	0.29
Follow-up	524.61	71.10	514.84	82.68	
SD-Sleep Latency					
Baseline	57.75	48.49	35.19	33.46	0.41
Follow-up	64.51	50.12	19.58	24.64	
SD-WASO					
Baseline	43.68	50.62	48.19	50.84	0.99
Follow-up	24.04	35.31	25.10	41.89	
SD-TST					
Baseline	365.97	82.29	382.68	111.93	0.66
Follow-up	415.41	50.37	438.91	121.98	
SD-Sleep Efficiency					
Baseline	73.00	12.55	72.04	17.63	0.40
Follow-up	79.70	10.21	85.21	20.54	
Feeling Rested					
Baseline	2.27	0.87	2.47	0.75	0.007
Follow-up	2.32	0.55	3.00	0.58	
Sleep Quality					
Baseline	2.31	0.95	2.61	0.74	0.029
Follow-up	2.26	0.60	3.00	0.72	

Note. SD = sleep diary; S.D. = standard deviation; WASO = wake after sleep onset; TST = total sleep time; ES = Effect Size

Table 4.

Comparison of Sleep, Mood and Quality of Life Measures

Measurement	Control (<i>n</i> = 11)		Experimental (<i>n</i> = 15)		<i>p</i> value
	Mean	S.D.	Mean	S.D.	
Pittsburgh Sleep Quality Index Global Score (PSQI)					
Baseline	10.00	2.62	9.49	3.86	0.07
Follow-up	8.73	2.21	6.29	3.87	
Dysfunctional Beliefs & Attitudes About Sleep (DBAS)					
Baseline	4.76	1.15	4.49	0.95	0.21
Follow-up	4.52	1.02	3.84	1.16	
Epworth Sleepiness Scale (ESS)					
Baseline	6.64	5.66	6.14	4.33	0.99
Follow-up	5.82	3.97	5.50	4.86	
Profile of Mood States Fatigue Subscale (POMS-F)					
Baseline	8.90	5.00	8.43	6.12	0.42
Follow-up	8.60	4.35	6.71	6.12	
Hospital Anxiety & Depression Scale–Anxiety (HADS-A)					
Baseline	5.90	2.85	6.00	3.83	0.69
Follow-up	7.27	3.35	6.15	4.45	
Hospital Anxiety & Depression Scale–Depression (HADS-D)					
Baseline	4.10	2.60	5.77	4.32	0.26
Follow-up	4.64	2.25	4.85	4.02	
FACT-L					
Baseline	89.20	23.84	84.07	22.72	0.049
Follow-up	74.67	26.40	90.73	21.35	

Table 5.

Feasibility Data

Procedure	Attention Control N=14 Mean +/-SD (min/max)	Experimental N=16 Mean +/-SD (min/max)
Intervention training (minutes)	52 +/- 10.1 (36/65)	46 +/- 9.0 (35/60)
FU phone call #1 (minutes)	21 +/- 5.6 (12-29)	31 +/- 10.2 (16-46)
FU phone call #2 (minutes)	21 +/- 4.0 (15-27)	33 +/- 8.2 (19-44)

Table 6.

Completion Data

Procedure	Attention Control N=14	Experimental N=16
Intervention Training	13	15
Follow Up Phone Call #1	11	11
Follow Up Phone Call #2	10	8
End of treatment visit	14	16