Original Article

# Developing Efficient and Effective Behavioral Treatment for Insomnia in Cancer Survivors: Results of a Stepped Care Trial

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**BACKGROUND:** Insomnia is common among cancer survivors. Although behavioral treatments for insomnia are effective, access is limited. Stepped care delivery models may provide insomnia treatment that is more efficient and accessible to cancer survivors. **METHODS:** Fifty-one survivors (mean age, 55 years) with elevated Insomnia Severity Index (ISI) scores (≥12) first participated in Sleep Training Education Program (STEP)-1: a single, sleep education session. Those reporting elevated ISI scores 1 month later were offered STEP-2: a 3-session, group cognitive behavioral treatment for insomnia that has been demonstrated to be efficacious. Participants were considered treatment responders if their ISI score improved by ≥6 points and were considered as having remitted if their posttreatment ISI score was <12. Mood was assessed with the Profile of Mood States–Short Form (POMS-SF). **RESULTS:** Following STEP-1, ISI scores improved (17.1 to 11.2; $P < .001$), with 45% responding and 41% remitted. Insomnia remission after STEP-1 was associated with lower insomnia severity and shorter duration of sleep problems at baseline. Of the 30 (59%) survivors with unremitted insomnia after STEP-1, 14 (47%) participated in STEP-2. Following STEP-2, ISI scores improved (16.9 to 8.8; $P < .001$), with 79% responding and 71% remitted. STEP-2 participation was associated with interest in sleep treatment at baseline, but not demographic/health-related variables. Mood improved significantly following both STEP-1 and STEP-2 ($P < .001$). **CONCLUSION:** A stepped care approach to treating insomnia among cancer survivors has the potential to improve treatment accessibility. A sizable proportion of survivors can benefit from 2 different low-intensity approaches that could be delivered by nonsleep specialists. For individuals who require more intensive care, assessing treatment interest can identify those who are likely to engage. ***Cancer* 2020;126:165-173**. © *2019 American Cancer Society*.

**KEYWORDS:** cancer survivor, cognitive-behavioral therapy for insomnia, insomnia, stepped care.

## INTRODUCTION

There are more than 15.5 million cancer survivors in the United States, and this number is expected to increase due to improvements in early detection, better cancer therapies, and an aging population.[1] As a result, there is greater emphasis on addressing their considerable survivorship concerns. Insomnia is one of the most commonly experienced survivorship difficulties, affecting up to 30% of patients years after treatment has ended.[2,3] More than simply a few bad nights of sleep, chronic sleep problems are associated with a wide range of significant health sequelae in the general and cancer population.[4,5]

Based on compelling efficacy data, the American College of Physicians has recommended cognitive behavioral therapy for insomnia (CBT-I) as the initial treatment for chronic insomnia disorder in adults.[6] CBT-I addresses cognitive and behavioral factors that maintain insomnia using core treatment components of sleep restriction (shortening time spent in bed to consolidate sleep), stimulus control (restricting bedroom activities to create an association between the bed and sleep), sleep hygiene (development of good sleep habits), cognitive therapy (changing dysfunctional beliefs about sleep), and relaxation therapy.[7] Although research has shown that CBT-I significantly improves sleep in cancer survivors,[8] it is not widely available in the community or at most cancer centers.[9] Provider-level treatment barriers include lack of physician training about sleep and a shortage of CBT-I specialists.[10,11] Patient-related barriers include limited understanding of the health consequences of insomnia and lack of awareness of available behavioral treatments.[12] In addition, CBT-I treatment can be burdensome, with 14%-40% of participants estimated to withdraw before the conclusion of treatment, due to challenges such as the duration of standard treatment (approximately 6-8 sessions) and the challenges of making sleep-related behavioral changes.[13]

Given the prevalence of insomnia among cancer survivors and difficulties they encounter accessing evidence-based treatment, we conducted a trial of a stepped care insomnia program. Stepped care in psychological care delivery has been

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proposed to address treatment barriers such as the discrepancy between the limited supply of trained providers and the demand for treatment. In this model of care, an "entry level" treatment should be readily accessible, be delivered at the lowest level of therapeutic intensity, inconvenience patients the least, be provided at the lowest cost, and require the least amount of specialist time.[14] Sleep hygiene recommendations meet all of these criteria and typically include general guidelines about individual behaviors (eg, caffeine consumption, exercise) and environmental factors (eg, bedroom noise level) that can affect sleep.[15,16] As this is the most commonly delivered treatment for insomnia,[17] we chose to develop and deliver a "best practice" version of sleep hygiene recommendations as the entry level treatment in our trial. For those whose insomnia does not resolve following this initial step, we offered a group-based CBT-I program that we have demonstrated to be efficacious among cancer survivors.[18] We believe that these lower-intensity approaches are more likely to be disseminated in hospitals without a behavioral sleep specialist on staff and could also be easier for patients who suffer from insomnia to engage in due to the lower commitment required.

## MATERIALS AND METHODS

### *Sample*

Participants were recruited by study staff at scheduled medical appointments in our cancer center, through oncologist referrals, clinic and newspaper advertisements, and mailed invitations to a local cohort of cancer survivors. A total of 163 adult cancer survivors were screened for the following inclusion criteria: no active cancer therapy (excluding chemoprevention) in the past year, no cancer therapy or surgery planned in the next 6 months, an Insomnia Severity Index (ISI) score ≥12, and English fluency. Of these survivors, 18 were ineligible based on ISI score, 40 were ineligible because of another untreated sleep disorder, and 16 were ineligible for other reasons (Supporting Fig. 1). Ultimately, 56 individuals were enrolled in the trial; however, 1 of these individuals did not complete any assessments or intervention sessions and was therefore excluded, yielding a final sample of 55 (Table 1).

### *Procedure*

Study procedures were approved by the hospital's institutional review board, conducted in accordance with the Declaration of Helsinki, and registered at ClinicaTrials.gov (NCT 02756390). All participants provided written consent prior to participation.

**TABLE 1.** Demographic and Medical Characteristics of Study Participants (N = 55)

| Participant Characteristics | Values |
|---|---|
| *Demographic characteristics* | |
| Age, y, mean (SD) | 54.35 (14.99) |
| Sex, n (%) | |
| Female | 49 (89.1) |
| Male | 6 (10.9) |
| Race/Ethnicity, n (%) | |
| Caucasian | 50 (90.9) |
| African American | 3 (5.5) |
| Hispanic | 1 (1.8) |
| Asian/Pacific Islander | 1 (1.8) |
| Native American or Alaskan Native | 1 (1.8) |
| Marital status, n (%) | |
| Married/Living as married | 37 (67.3) |
| Single | 9 (16.4) |
| Divorced | 7 (12.7) |
| Widowed | 2 (3.6) |
| Education, n (%) | |
| GED certification | 1 (1.8) |
| Completed high school | 2 (3.6) |
| Training after high school | 2 (3.6) |
| Currently in college | 4 (7.3) |
| Some college | 4 (7.3) |
| College graduate | 19 (34.6) |
| Postgraduate | 23 (41.8) |
| Employment status, n (%) | |
| Working full-time | 26 (47.3) |
| Working part-time | 8 (14.5) |
| Student | 4 (7.3) |
| Disabled and unable to work | 3 (5.4) |
| Unemployed, looking for work | 1 (1.8) |
| Unemployed, not looking for work | 4 (7.2) |
| Retired | 10 (18.2) |
| Annual household income, n (%) | |
| <$25,000 | 7 (13.7) |
| $25,000-$49,999 | 9 (17.6) |
| $50,000-$74,999 | 7 (13.7) |
| $75,000-$99,999 | 13 (25.5) |
| ≥$100,000 | 14 (27.5) |
| Missing | 1 (1.8) |
| *Medical characteristics* | |
| Years since cancer diagnosis, mean (SD) | 10.32 (7.65) |
| Diagnosis, n (%) | |
| Breast cancer | 35 (63.6) |
| Lymphoma | 9 (16.4 |
| Leukemia | 5 (9.1) |
| Other (sarcoma, head and neck, brain, neuroblastoma, thyroid, Wilms tumor) | 6 (10.9) |

Abbreviations: GED, General Education Development; SD, standard deviation.

### Stepped care program

The Sleep Training Education Program (STEP) comprises 2 levels of intervention.

**STEP-1 (sleep education).** The entry level in our stepped care approach was a single, hour-long sleep education session facilitated by a clinical psychologist. The session content focused on 1) providing psychoeducation about insomnia in cancer survivors; 2) introducing participants to sleep hygiene principles; 3) identifying 2 to 3 of the most relevant sleep hygiene strategies for each participant; and 4) developing a plan

to consistently implement the recommended behavior changes over the next month.

**STEP-2 (group CBT-I).** The second level of intervention was a 3-session, group-based CBT-I program previously developed and tested for adult cancer survivors.[18] Sessions were led by study investigators (ESZ and CJR) and were supplemented by a workbook providing further information and examples tied to session material. Session 1 provided instruction on the etiology and maintenance of insomnia and proper completion of sleep diaries. Session 2 focused on stimulus control and sleep restriction and provided participants with an individualized sleep schedule based on their sleep diary data. Session 3 instructed participants on sleep expansion and sleep hygiene and addressed cancer late-effects and maladaptive sleep cognitions, as well as long-term adherence.

### Study measures

**Demographics and medical history.** Demographic information, as well as medical information including cancer diagnosis and treatment, were collected by self-report and medical record review.

**Insomnia Severity Index (ISI).** The ISI[19] is the most commonly used measure in insomnia research and has been validated in cancer populations.[20] It has demonstrated adequate internal consistency and is sensitive to detect changes in perceived sleep difficulties with treatment.

**Profile of Mood States–Short Form (POMS-SF).** The POMS-SF[21] is a 35-item measure, which assesses several dimensions of mood states and includes an overall Total Mood Disturbance (TMD) score.

**Sleep problem information.** Participants were asked to estimate the duration of their sleep problems. In addition, they were asked to report the perceived burden of their sleep problems and their level of interest in seeking help for their sleep problems on a scale of 1 to 10 (where higher scores equated to more burden or greater interest).

**Sleep treatment change.** Participants were asked to report any changes made in their use of sleep medications (over-the-counter or prescribed) during the study period.

### Study procedure

Participants were invited to start the intervention on the day of enrollment or schedule for a later date. At study baseline assessment prior to STEP-1, all participants completed the ISI and POMS-SF (Fig. 1). Four weeks after the completion of STEP-1, participants completed these same measures and sleep treatment change at the (STEP-1) 4-week follow-up. If their ISI remained ≥12, they were referred to STEP-2. Participants with ISI <12 at this time point were monitored with ISI assessments and referred to STEP-2 if their ISI score was ≥12 at either 8 or 12 weeks after STEP-1.

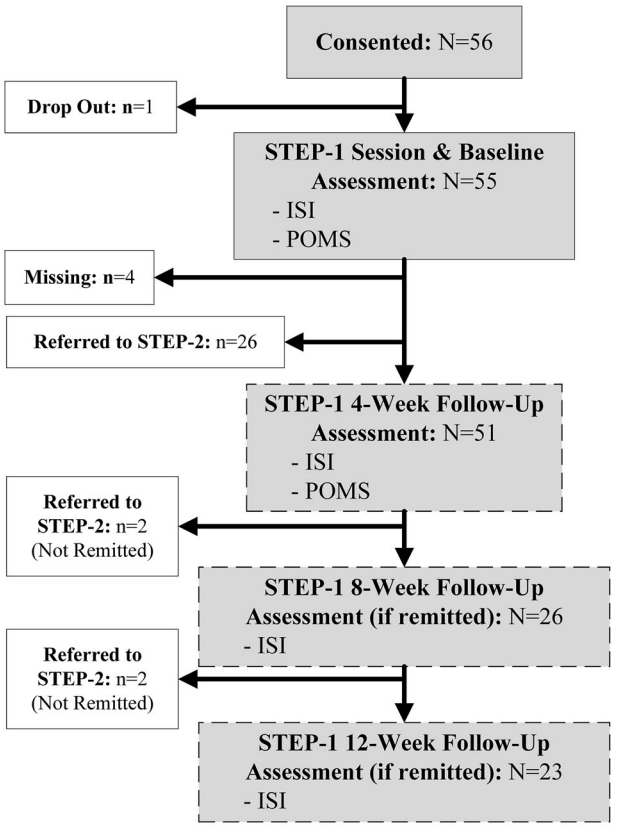


**Figure 1.** Sleep Training Education Program (STEP)-1 schematic. ISI, Insomnia Severity Index; POMS, Profile of Mood States.

STEP-2 was offered to referred participants on 9 potential dates over a 15-month period. All participants referred to STEP-2 who did not attend were offered at least 3 group dates, including at least 1 weekday, weeknight, and weekend time, with at least 3 months prior notice for each group. At the initial STEP-2 session, participants completed the ISI and POMS-SF. The ISI, POMS-SF, and sleep treatment change were given at (STEP-2) 4-week and 8-week follow-up assessments (Figs. 1 and 2). The median interval between STEP-1 completion and STEP-2 initiation was 1.5 months, with 78.6% of participants initiating STEP-2 within 3 months.

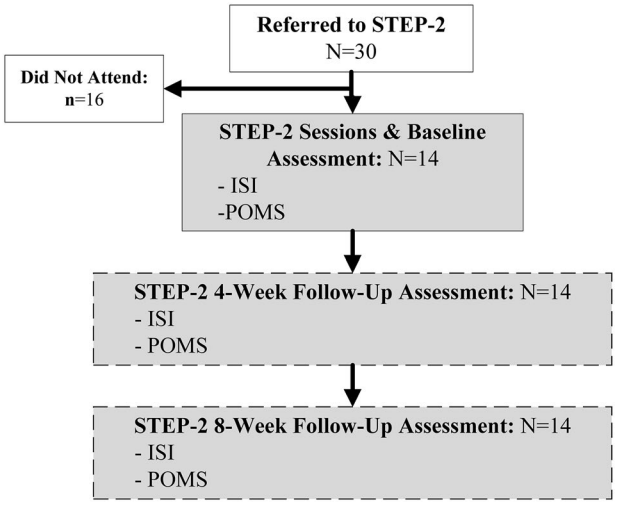


**Figure 2.** Sleep Training Education Program (STEP)-2 schematic. ISI, Insomnia Severity Index; POMS, Profile of Mood States.

### *Data Analysis*

Descriptive statistics were used to describe demographic and medical characteristics. The primary analysis of change in ISI scores was conducted separately for each step of the intervention; baseline ISI scores were compared with ISI scores at each follow-up assessment using paired *t* tests. Cohen's *d* was calculated as a measure of effect size. Change in POMS-SF scores were analyzed similarly, with baseline POMS-SF scores being compared with POMS-SF scores at each follow-up assessment using paired *t* tests. For descriptive purposes, participants whose ISI score decreased by ≥1 point were considered as having improved. Following published recommendations,[22] those participants whose ISI scores decreased by ≥6 points were considered treatment responders. Participants with postintervention ISI scores <12 were considered as having remitted.[23,24] Differences between participants with remitted versus unremitted insomnia on demographic, medical, mood, and sleep variables were evaluated with independent *t* tests. Additionally, among participants referred to STEP-2, differences between those who attended and those who did not were similarly assessed using independent *t* tests.

Four participants who attended the STEP-1 session but did not complete any follow-up assessments were excluded from primary analyses. In a secondary analysis, we conservatively estimated their (STEP-1) 4-week follow-up ISI and POMS-SF TMD scores using the last observation carried forward approach (which assumes they had no change on these measures after the intervention) and repeated the analyses for (STEP-1) 4-week follow-up ISI and POMS-SF data.

## RESULTS

### *STEP-1 (Sleep Education)*

At STEP-1 4-week follow-up, participants reported significant improvement in insomnia compared with baseline. Mean ISI scores decreased significantly from 17.1 to 11.2 ($d = 1.2$; $P < .001$) (Fig. 3), and POMS-SF scores showed significant improvement in 5 of 7 mood subscales and the summary TMD scale (Table 2). At 4-week follow-up, 88.2% of the 51 participants reported improved sleep, 45.1% were treatment responders, and 51.0% had remitted (Table 3). Among the 26 participants whose insomnia remitted at 4 weeks, ISI scores continued to improve with further reductions in symptoms at 8- and 12-week follow-up. Compared with survivors with unremitted insomnia at this step, those with remitted insomnia had a shorter duration (4.1 years [standard deviation (SD) 1.2 years] versus 4.8 years [SD 1.2 years], respectively; $P < .05$), and less perceived burden (mean 6.2 [SD 1.6] versus mean 7.2 [SD 1.3], respectively; $P < .05$) from sleep problems and less pain (mean 1.8 [SD 1.1] versus mean 4.2 [SD 2.5], respectively; $P < .001$). Survivors with remitted versus unremitted insomnia did not differ with regard to demographic characteristics (age, sex, marital status, level of education, annual household income), psychological factors (psychological distress), medical factors (cancer diagnosis, cancer treatments, time since treatment), level of interest in help for sleep problems, or STEP-1 baseline ISI score.

On the sleep treatment change questions at 4-week follow-up, 1 participant endorsed starting an over-the-counter medication for sleep, and 3 participants endorsed decreasing the amount of prescribed or over-the-counter medication they were using for sleep. Of note, to ensure our results were not overly influenced by the 4 STEP-1 participants who did not complete any follow-up assessments, we repeated our 4-week follow-up analysis assuming they had no change in ISI or POMS-SF TMD scores following the intervention (last observation carried forward). Results including these additional 4 cases were highly similar, with mean ISI scores changing from 17.3 to 11.9 ($d = 1.1$; $P < .001$) and mean POMS-SF TMD scores changing from 15.6 to 9.4 ($d = 0.5$; $P < .005$).

### *STEP-2 (Group CBT-I)*

Based on continued insomnia symptoms following STEP-1, 30 survivors were referred to STEP-2 (25 survivors were referred based on an ISI score ≥12 at 4-weeks after STEP-1 and 5 based on ISI ≥12 at 8 weeks after

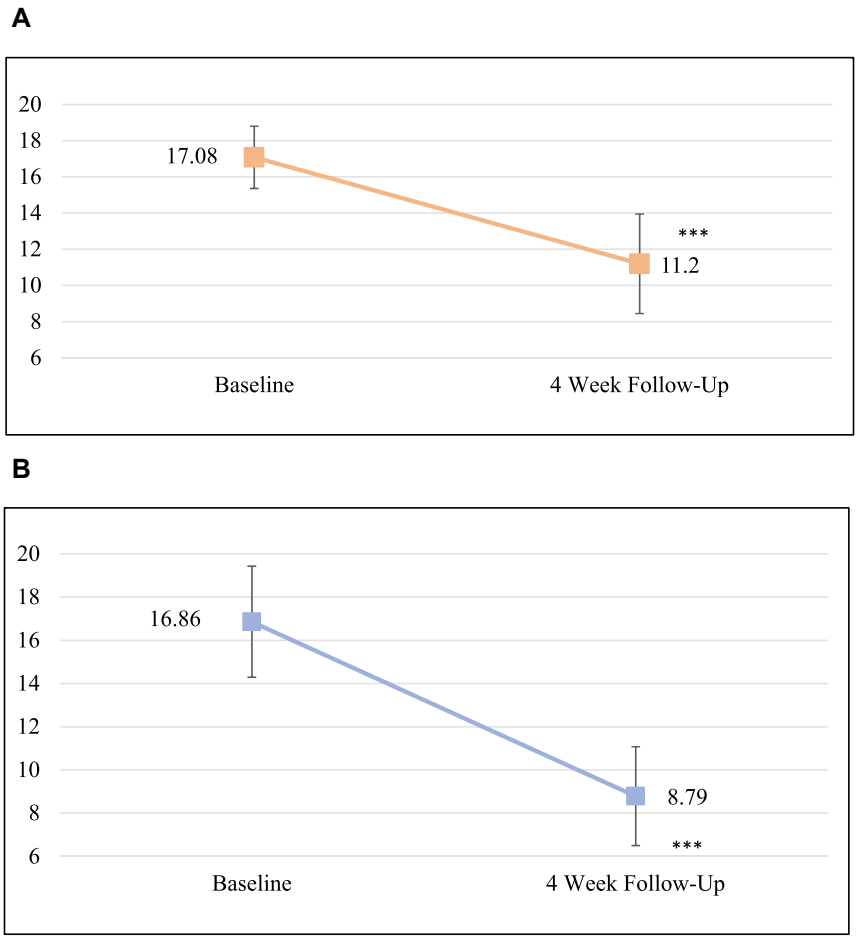


**Figure 3.** Mean change in Insomnia Severity Index (ISI) scores. (A) Sleep Training Education Program (STEP)-1 (sleep education): n = 51. (B) STEP-2 (group CBT-I): n = 14. Paired *t* tests were used to compare follow-up ISI scores with baseline ISI scores. *$P < .05$; **$P < .01$; ***$P < .001$. CBT-I, cognitive behavioral therapy for insomnia.

STEP-1), which was offered at multiple times and dates (described in the Study Procedure section). A total of 14 survivors attended the STEP-2 intervention. At both 4-week and 8-week follow-up, the 14 participants who attended STEP-2 reported significant improvement in insomnia compared with baseline with large effect sizes ($d \geq 1.5$; $P < .001$) (Fig. 3). Overall mood scores (POMS-SF TMD) also improved, but difference from baseline was significant only at 8-week follow-up. POMS-SF subscale fatigue and vigor scores showed similar improvement at 4-week follow-up and fatigue scores also showed significant improvement at 8-week follow-up. At 4 weeks after STEP-2, all 14 participants reported improved sleep. Of these 14 participants, 12 (85.7%) were treatment responders and 12 (85.7%) had remitted (Table 3). On the sleep treatment change questions at 4- and 8-week follow-up, no participants endorsed starting a new sleep medication, but 1 participant reported decreasing use of an over-the-counter sleep medication at 8-week follow-up.

Compared with survivors who did not undergo STEP-2 (n = 16), STEP-2 attendees reported a higher level of interest in seeking help for their sleep problems at their STEP-1 baseline (mean 9.4 [SD 0.9] versus mean 8.2 [SD 1.3], respectively; $P < .05$). Attendees and nonattendees did not differ with regard to demographic characteristics (age, sex, marital status, level of education, annual household income), psychological factors (psychological distress), medical factors (cancer diagnosis, cancer treatments, time since treatment, pain), burden of sleep problems, length of sleep problems, or STEP-2 baseline ISI score.

**TABLE 2.** Change in ISI and POMS-SF Score at Follow-up Time Points for STEP-1 (Sleep Education) and STEP-2 (Group CBT-I)

| | Baseline | | 4-Week Follow-Up | | | 8-Week Follow-Up | | | 12-Week Follow-Up | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | Mean (SD) | n | Mean (SD) | *d* | n | Mean (SD) | *d* | n | Mean (SD) | *d* |
| *STEP-1 (sleep education)* | | | | | | | | | | | |
| ISI | 51 | 17.08 (3.44) | 51 | 11.20 (5.50)*** | 1.18 | 26[a] | 6.85 (3.87)*** | 1.62 | 23[a] | 6.09 (3.58)*** | 2.2 |
| POMS-SF | | | | | | | | | | | |
| Total mood disturbance | 45 | 14.76 (17.74) | 45 | 8.00 (16.23)** | 0.50 | | | | | | |
| Anger, hostility | 47 | 2.87 (2.78) | 47 | 2.30 (2.58) | 0.18 | | | | | | |
| Confusion, bewilderment | 54 | 3.63 (3.29) | 47 | 3.15 (3.70)** | 0.41 | | | | | | |
| Depression, dejection | 47 | 2.19 (3.42) | 47 | 1.51 (1.82) | 0.26 | | | | | | |
| Fatigue, inertia | 55 | 9.62 (4.92) | 47 | 6.62 (4.70)*** | 0.66 | | | | | | |
| Tension, anxiety | 55 | 5.40 (4.64) | 47 | 4.45 (3.69)* | 0.31 | | | | | | |
| Vigor, activity | 54 | 9.15 (3.97) | 47 | 9.96 (4.36)* | 0.36 | | | | | | |
| *STEP-2 (group CBT-I)* | | | | | | | | | | | |
| ISI | 14 | 16.86 (5.14) | 14 | 8.79 (4.58)*** | 2.02 | 14 | 9.5 (3.35)*** | 1.53 | | | |
| POMS-SF | | | | | | | | | | | |
| Total mood disturbance | 14 | 15.79 (17.11) | 13 | 5.31 (10.16) | 0.49 | 14 | 7.71 (10.59)* | 0.74 | | | |
| Anger, hostility | 14 | 2.50 (2.35) | 14 | 2.43 (1.95) | 0.03 | 14 | 2.36 (1.74) | 0.06 | | | |
| Confusion, bewilderment | 14 | 3.29 (4.08) | 13 | 1.77 (1.59) | 0.29 | 14 | 2.50 (3.39) | 0.26 | | | |
| Depression, dejection | 14 | 2.21 (2.99) | 14 | 1.50 (1.79) | 0.34 | 14 | 0.86 (0.77) | 0.50 | | | |
| Fatigue, inertia | 14 | 9.43 (5.71) | 14 | 6.00 (3.64)* | 0.65 | 14 | 6.86 (5.28)* | 0.74 | | | |
| Tension, anxiety | 14 | 5.14 (3.01) | 14 | 3.86 (3.09) | 0.53 | 14 | 3.14 (2.35)* | 0.71 | | | |
| Vigor, activity | 14 | 6.79 (4.64) | 14 | 8.71 (3.69)* | 0.76 | 14 | 8.00 (4.47) | 0.41 | | | |

Abbreviations: CBT-I, cognitive behavioral therapy for insomnia; ISI, Insomnia Severity Index; POMS-SF, Profile of Mood States-Short Form; SD, standard deviation; STEP, Sleep Training Education Program.
Paired *t* tests were used to compare follow-up assessments with baseline assessments.
[a]Only participants remitted at STEP-1 4-week follow-up completed the ISI 8 and 12 weeks after STEP-1; nonremitted participants were referred to STEP-2.
*$P < .05$; **$P < .01$; ***$P < .001$.

**TABLE 3.** Participant Improvement, Response, and Remission at 4-Week Follow-up

| | STEP-1 (Sleep Education), n = 51 | STEP-2 (Group CBT-I), n = 14 |
|---|---|---|
| Improved (ISI improved by ≥1 point) | 45 (88.2) | 14 (100.0) |
| Responded (ISI improved by ≥6 points) | 23 (45.1) | 12 (85.7) |
| Remitted (ISI <12) | 26 (51.0) | 12 (85.7) |

Abbreviations: CBT-I, cognitive behavioral therapy for insomnia; ISI, Insomnia Severity Index; STEP, Sleep Training Education Program.
Data are presented as n (%).

## DISCUSSION

Stepped care models have been recommended as a way to improve access and deliver care efficiently and have been successfully implemented in psychosocial care for cancer patients.[25] Our findings demonstrate that stepped care is effective for insomnia in cancer survivors and that a sizable proportion of cancer survivors suffering from insomnia experience meaningful symptom improvement from a low-intensity sleep hygiene education session.

In existing stepped care models for insomnia, levels of care are distinguished by how treatment is delivered. The first step is typically a form of self-directed therapy (eg, internet-based CBT-I), up to the highest step of individual sessions with a sleep specialist.[26-28] However, these levels of care are typically not differentiated by intervention content or duration. This leaves an important barrier to treatment, as even the first treatment step still requires a significant patient commitment to the full course of CBT-I, which is approximately 6 to 8 sessions or modules. Ideally, the entry level to insomnia care should be the lowest dose proven to be associated with clinical improvement[26]; our data demonstrate that more than half of cancer survivors with insomnia can benefit appreciably from an hour-long program that empowers patients by teaching them about sleep health and provides concrete instruction on how to change their sleep behaviors. For those survivors whose insomnia does not resolve following this first step, a group-based CBT-I program that was designed to be a lower-intensity intervention than standard CBT-I is also efficacious.[18] Although we tested the STEP-1 and STEP-2 interventions as administered by PhD level clinicians, demonstrating their efficacy when delivered online or by paraprofessionals will be an important step to further increase their dissemination to survivors.

Our results have important implications for cancer centers and community oncology settings developing a sleep program. These findings provide information about which patients are most likely to benefit from a short course of care and which ones can be expected to engage in higher intensity levels of treatment. Existing literature has been mixed, without clear demographic, medical, or psychological characteristics consistently associated with CBT-I adherence.[13] We found that cancer survivors who had experienced sleep problems for a shorter period and perceived less burden from their sleep problems and less pain were most likely to benefit from a single sleep hygiene education session. This finding suggests that it is crucial to identify patients with disturbed sleep as early as possible, before they have had to bear the negative effects of insomnia.[29] Routine screening for sleep disorders is already supported by clinical practice guidelines for survivors,[30] and our data indicate that early identification and treatment may enhance efficacy of brief low-intensity interventions. In exploring adherence of participants referred for a second, more intense level of treatment, we did not identify demographic or medical variables that were associated with greater likelihood of participation. Rather, participants reporting a greater level of interest in pursuing sleep treatment was predictive of enrollment in STEP-2. Although this result is consistent with a previous study in a sample of breast cancer survivors in which higher levels of baseline motivation to change sleep behaviors was associated with adherence to CBT-I recommendations,[31] its implications are not entirely clear. The fact that survivors without strong motivation to improve their sleep are less likely to engage in more demanding treatments may not be cause for great concern if it is viewed as reflecting their autonomy, values, and priorities. On the other hand, if low levels of motivation reflects a lack of self-efficacy and information about the health impact of insomnia and the benefits of treatment, the lack of motivation for change may itself be an important target for intervention. Qualitative and quantitative research methods will likely be needed to better understand factors affecting baseline motivation and its impact on adherence.

These findings demonstrating that sleep hygiene education can be effective at improving insomnia symptoms may be surprising, as sleep hygiene alone is often viewed as ineffective and is even used as the control condition in trials of CBT-I.[16] However, it should be noted that in prior research, sleep hygiene is often delivered as a handout with limited instructions on how to actually enact the advised sleep behavior and/or environment changes, or guidance on reasonable

expectations for a timeline for sleep improvements. Efficacy of the STEP-1 intervention here may reflect the delivery of the sleep hygiene information as part of a more comprehensive educational session about insomnia in cancer patients that includes structured information about how to make behavioral changes to improve sleep. Alternatively, the efficacy of STEP-1 in our participants may be because cancer patients are naïve to the basic principles of sleep hygiene, unlike patients who seek treatment in specialized sleep medicine program. Replication of our findings and assessment of pretreatment familiarity with sleep hygiene principles will be useful in evaluating these possible explanations.

This study is not without its limitations. We acknowledge our sample is relatively homogenous (primarily white women with a higher socio-economic status) drawn from a single center. It is important to study behavioral sleep interventions in diverse populations. Additionally, we did not collect objective sleep data (eg, actigraphy), although self-report on the ISI is a commonly used primary endpoint in insomnia intervention trials.[8] Our study also lacked a control group, a limitation we plan to address in future trials. Finally, 17 of 56 (30.3%) participants did not complete some or all of the recommended intervention steps. This is consistent with attrition reported in previous CBT-I trials,[13] but it is notable that 16 of 17 cases of attrition occurred when survivors chose not to attend STEP-2, whereas all survivors who began STEP-2 completed treatment. We did not directly assess why these participants who continued to experience insomnia after STEP-1 chose not to enroll in STEP-2. Consequently, we do not have data on the factors that influenced their decision, including the long-term course of their insomnia. Future research aimed at understanding these factors will be essential to helping survivors engage in available evidence-based treatments best suited to their needs.

It has been said of CBT-I that "doubts…do not reside in its efficacy, nor even in its effectiveness, but in its feasibility. Can [CBT-I] really become a first line treatment for insomnia in everyday practice?"[26] as the American College of Physicians has recommended.[6] Our efforts here seek to balance the desire for every patient with insomnia to receive the full course of the gold standard treatment, with the reality of survivorship care at most cancer centers which are appropriately focused primarily on delivering cancer treatment. The implementation of at least the first step in our program (a sleep education session) is reasonable to consider as a part of a commitment to quality survivorship care, even at less resourced sites. This represents a tremendous opportunity to successfully treat a common problem for cancer survivors that has significant health consequences when ignored.

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## CONFLICT OF INTEREST DISCLOSURES

The authors made no disclosures.

## AUTHOR CONTRIBUTIONS

**Eric S. Zhou:** Conceptualization, methodology, investigation, writing–original draft, writing–review and editing, and visualization. **Alexis L. Michaud:** Formal analysis, data curation, writing–original draft, writing–review and editing, and visualization. **Christopher J. Recklitis:** Conceptualization, methodology, formal analysis, investigation, resources, writing–original draft, writing–review and editing, visualization, supervision, project administration, and funding acquisition.

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