Pilot randomized controlled trial of eHealth cognitive-behavioral therapy for insomnia among Spanish-speaking breast cancer survivors

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Abstract Cognitive-Behavioral Therapy for Insomnia (CBT-I) is the gold-standard treatment for insomnia, which is common among breast cancer survivors (BCS). This pilot randomized controlled trial tested the first CBT-I intervention for Spanish-speaking BCS delivered using eHealth. Participants (N = 30) were Spanish-speaking BCS with insomnia symptoms recruited in Puerto Rico and randomized to a 6-week eHealth CBT-I group intervention or a waitlist control. Primary outcomes were acceptability (recruitment, treatment satisfaction) and feasibility (retention, attendance). Secondary outcomes were group differences in sleep outcomes post-treatment (i.e., insomnia symptoms, sleep disturbance, sleep efficiency). Recruitment (95%) and retention (97%) were excellent. All CBT-I participants (100%) attended ≥ 3 of 6 sessions. Satisfaction with CBT-I was acceptable. Post-intervention, there were medium to large group differences for average insomnia symptoms (d = 1.02), sleep disturbance (d = 1.25), and sleep efficiency (d = 0.77) favoring CBT-I. There were small/medium to medium/large group differences for the proportion of participants with clinically significant insomnia symptoms (d = 0.52), sleep disturbance (d = 0.67), and low sleep efficiency (d = 0.33) favoring CBT-I. Spanish-language eHealth CBT-I for BCS was acceptable and feasible and showed preliminary efficacy.

Keywords Breast cancer · Hispanic Americans · Insomnia · Randomized controlled trial · Sleep

Introduction

Breast cancer and its treatments can perpetuate symptoms of insomnia, resulting in three to five times higher incidence of insomnia in breast cancer survivors (BCS) relative to the general population (Ganz et al., 2011). Insomnia in BCS is a significant public health burden, in part because BCS are one of the largest groups of cancer survivors in the United States (ACS, 2021). The gold-standard treatment for insomnia is Cognitive-Behavioral Therapy for Insomnia (CBT-I), a non-pharmacologic intervention with behavioral, cognitive, and educational components. CBT-I improves many outcomes among BCS, including sleep, fatigue, and quality of life (Arico et al., 2016; Savard et al., 2005a). It is important that CBT-I be available to all BCS with symptoms of insomnia. Yet, there are a lack of resources for the underserved population of Spanish-speaking BCS. This is a critical oversight, as Hispanics report worse insomnia symptoms than non-Hispanics (Kaufmann et al., 2016).

To address this unmet need, this pilot randomized controlled trial (RCT) tested the first manualized Spanish-language CBT-I group intervention for BCS, which was delivered using eHealth. eHealth is defined as delivering care using information and communication technology (World Health Assembly, 2005) and shows promise for reducing insomnia in BCS (Zachariae et al., 2018). Goals of this pilot RCT were consistent with Phase II of the ORBIT Model for developing behavioral interventions (Czajkowski et al., 2015), which
encourages small pilot and feasibility RCTs to show the clinical significance of an intervention and justify large efficacy RCTs. It was hypothesized that the trial would be acceptable and feasible (primary outcomes) and preliminary efficacy would favor the eHealth CBT-I intervention condition (secondary outcomes).

**Methods**

**Participants and procedures**

This study was approved by Advarra Institutional Review Board (Pro00034140) and pre-registered on ClinicalTrials.gov (NCT04101526). Eligibility criteria were: (1) ≥ 18 years old; (2) speak and read Spanish; (3) finished primary cancer treatment (e.g., surgery, chemotherapy, radiation); (4) reported clinically significant insomnia symptoms (i.e., Insomnia Severity Index score ≥ 8) (Morin et al., 2011); (5) low risk of sleep disorders not amenable to CBT-I (e.g., obstructive sleep apnea) assessed with a professionally translated version of the Duke Structured Interview for Sleep Disorders (Edinger et al., 2009); and (6) had access to the Internet and a digital device capable of using videoconferencing software (e.g., smartphone). Individuals with a psychiatric or neurological disorder that could preclude study participation were excluded.

The CBT-I group intervention was intended to be administered in person, and the protocol was amended for eHealth/videoconference due to COVID-19 social distancing constraints. In November and December 2020, participants were recruited from oncology clinics and support groups in Puerto Rico using flyers, online bulletin board postings, and referrals (e.g., from support group leaders). Study staff conducted brief screenings to confirm eligibility. Eligible and interested BCS gave informed consent and completed a baseline survey online in Spanish. Participants were randomized (1:1) to the eHealth CBT-I group intervention or a waitlist control condition starting January 2021 to avoid holiday travel. A simple randomization table was uploaded to the online study database and concealed from study staff and participants. Participants completed a post-intervention survey online in Spanish six weeks after the first eHealth CBT-I session and received gift cards for completing the baseline ($25) and post-treatment surveys ($75). The pilot RCT ended after meeting the recruitment goal and conducting all CBT-I sessions.

**Study conditions**

**eHealth CBT-I intervention**

Groups of participants (k = 2 groups) joined weekly 90-min sessions for six weeks over videoconference. Sessions were recorded and transcribed. Groups included up to 10 participants. Sessions were led by a native Spanish-speaking licensed psychologist with post-graduate training in CBT-I (JMC) with assistance from a psychology graduate student. Sessions were guided by an evidence-based CBT-I treatment manual (Savard et al., 2005a) that was professionally translated from English to Spanish and reviewed by native Spanish-speaking study team members. Each week, the manual introduced new topics and reinforced previous topics, including sleep education (Session 1); sleep restriction (Session 2); stimulus control, sleep hygiene, and sleep medications (Session 3); cognitive restructuring (Sessions 4 and 5); and relapse prevention (Session 6). Participants were given printed educational content to review as well as blank sleep diaries to complete before each session based on the Consensus Sleep Diary (Carney et al., 2012). Participants received a text message reminder the day before each session with a web link to the videoconference and a request to send a photograph of their completed sleep diary. Trained study staff completed weekly fidelity checklists with 8–23 items per session after reviewing the session's transcript and video.

**Waitlist control**

Participants received no intervention until after the post-treatment survey. Then, they were offered the opportunity to participate in the eHealth CBT-I intervention.

**Measures**

**Acceptability and feasibility**

Acceptability was defined as the percent of eligible BCS who consented to participate (i.e., recruitment; cutoff ≥ 50%) and treatment satisfaction, assessed with a professionally translated version of the Treatment Perceptions Questionnaire (TPQ) (Marsden et al., 2007). The TPQ assessed agreement with 10 statements about treatment satisfaction on a Likert-type scale from 0 (strongly disagree) to 4 (strongly agree). Average scores ≥ 3 indicated acceptable satisfaction. Feasibility was defined as the percent of participants that completed the post-treatment survey (i.e., retention) and percent of eHealth CBT-I participants that attended ≥ 3 of 6 sessions (i.e., attendance). The cutoff for feasibility outcomes was ≥ 75%.

**Sleep**

Insomnia symptoms were assessed with the 7-item Insomnia Severity Index (ISI) (Morin et al., 2011), which evaluates difficulty falling/staying asleep and its functional impact. Scores ≥ 8 indicated clinically significant insomnia symptoms (Savard et al., 2005b). Internal consistency reliability
was adequate (Cronbach’s αs 0.76–0.90). Global sleep disturbance and sleep efficiency (i.e., percent of time in bed that is spent asleep) were assessed with the 19-item Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989), which evaluates subjective sleep quality, latency, duration, disturbance, use of sleep medication, and daytime dysfunction in the past month. Sleep disturbance scores ≥ 5 and sleep efficiency scores < 85% indicated clinically significant sleep disturbance and low sleep efficiency, respectively (Levenson et al., 2013; Lichstein et al., 2003). Internal consistency reliability was low (Cronbach’s αs 0.55–0.58). Validated Spanish versions of the ISI and PSQI were obtained from MAPI Trust (Lyon, France). For participants in eHealth CBT-I, sleep efficiency was also calculated from weekly sleep diaries.

Data analyses

To plan for a future RCT with 90% power to detect a medium effect, a sample of 15 participants per arm was considered acceptable (total recruitment goal N = 30) (Bell et al., 2018). Analyses were conducted with SAS version 9.4 (Cary, NC) using an a priori plan to determine acceptability and feasibility of the intervention (primary outcomes) and explore group differences in sleep outcomes post-treatment (secondary outcomes). Demographics were compared between groups using independent samples t-tests and Chi-square tests. Rates of recruitment, retention, and session attendance were calculated with percentages and 95% confidence intervals (CI). Treatment satisfaction was summarized with descriptive statistics. Cohen’s \(d\) effect sizes were used to describe the magnitude of group differences post-treatment for average insomnia symptoms, sleep disturbance, and sleep efficiency, as well as group differences post-treatment for the proportion of participants meeting established thresholds for clinically significant symptomatology. Effect sizes were calculated by subtracting the eHealth CBT-I group mean post-treatment from the waitlist control group mean post-treatment and dividing the result by the pooled standard deviation for both estimates. Effect sizes are described as small (0.20), medium (0.50), or large (≥ 0.80) (Cohen, 1988). Missing data were not imputed.

## Results

### Participant characteristics

Participants (N = 30) were an average of 58.44 years old (SD = 9.22), and 50% completed treatment less than five years prior (Table 1). Participants randomized to eHealth CBT-I (n = 15) and waitlist control (n = 15) did not differ by age (\(p = 0.37\)) nor time since treatment (\(p = 0.72\)).

### Primary outcomes: acceptability and feasibility

The recruitment rate was 91% (95% CI: 76–97%), and the retention rate was 97% (all but one; 95% CI: 90–100%) (Fig. 1). All eHealth CBT-I participants attended ≥ 3 of 6 intervention sessions (95% CI: 78–100%), and all but one completed all sleep diary entries (i.e., 7 sleep diary entries per week for 6 weeks; average completion rate 99.7%, range: 95–100%). Average satisfaction with eHealth CBT-I was 3.56 (SD = 0.28) (i.e., agreed to strongly agreed with positive statements). On average, fidelity checklist scores indicated that 88% (SD = 12) of the manual content was covered in each session.

### Secondary outcomes: insomnia symptoms, sleep disturbance, and sleep efficiency

#### Insomnia symptoms

There was a large difference between groups in average insomnia symptoms post-treatment (\(d = 1.02\)) (Fig. 2). Average scores decreased from 18.87 (SD = 4.49) to 7.80 (SD = 3.75) in eHealth CBT-I (n = 15) and from 17.20 (SD = 4.95) to 13.33 (SD = 6.69) in the control group (n = 14). There was a medium difference between groups post-treatment in the proportion of participants with clinically significant insomnia symptoms (\(d = 0.52\), with a decrease from 100 to 60% in eHealth CBT-I and from 100 to 83% in the control group (Fig. 3).

### Table 1 Baseline characteristics of participants

| Characteristic                      | Full sample (N = 30) | eHealth CBT-I intervention condition (n = 15) | Waitlist control condition (n = 15) | Group difference (p) |
|-------------------------------------|----------------------|-----------------------------------------------|-----------------------------------|----------------------|
| Age, years; M (SD)                  | 58.44 (9.22)         | 56.90 (8.91)                                  | 59.98 (9.58)                      | 0.37                 |
| Time since primary treatment        |                      |                                               |                                   | 0.72                 |
| Less than 5 years                  | 15 (50)              | 8 (53)                                        | 7 (47)                           |                      |
| More than 5 years                  | 15 (50)              | 7 (47)                                        | 8 (53)                           |                      |

This table shows the baseline characteristics of participants, including age and time since primary treatment, for participants in the full sample (N = 30), eHealth CBT-I intervention condition (n = 15), and waitlist control condition (n = 15). The table also includes the group difference (p) for each characteristic.
Sleep disturbance

There was a large difference between groups in average sleep disturbance scores post-treatment ($d = 1.25$) (Fig. 2B). Average scores decreased from 11.60 (SD = 3.74) to 7.40 (SD = 3.25) in eHealth CBT-I ($n = 15$) and did not change in the control group (baseline $M = 11.57$, SD = 3.25; post-treatment $M = 11.77$, SD = 3.72; $n = 14$). There was a medium to large difference between groups post-treatment in the proportion of participants with clinically significant sleep disturbance ($d = 0.67$), with a decrease from 100 to 67% in eHealth CBT-I and from 100 to 92% in the control group (Fig. 3).

Sleep efficiency

There was a medium to large difference between groups in average sleep efficiency post-treatment ($d = 0.77$) (Fig. 2C). Averages increased from 74% (SD = 18) to 83% (SD = 15) in eHealth CBT-I ($n = 15$) and decreased from 73% (SD = 12) to 70% (SD = 19) in the control group ($n = 14$). There was a small to medium difference between groups post-treatment in the proportion of participants with low sleep efficiency ($d = 0.33$), with a decrease from 73 to 53% in eHealth CBT-I and from 86 to 69% in the control group (Fig. 3). For participants in eHealth CBT-I, sleep diaries indicated that average sleep efficiency increased from 72% (SD = 11) before Session 1 to 80% (SD = 12) before Session 6.

Discussion

To our knowledge, this was the first study to test a manualized Spanish-language CBT-I group intervention for BCS. This study was acceptable and feasible, with excellent rates of recruitment, retention, and attendance and acceptable satisfaction in the eHealth CBT-I group. Effect sizes for group differences post-intervention demonstrated proof-of-concept that CBT-I improved sleep outcomes (i.e., insomnia symptoms, global sleep quality, and sleep efficiency) with medium to large effect sizes relative to a control group. In addition, group differences post-treatment for the proportion of participants with clinically significant symptomatology all favored the eHealth CBT-I condition, with small/medium to medium/large effect sizes.

Limitations of this pilot RCT include use of a waitlist control group. Although appropriate for this stage of investigation, a more robust attention-control comparison should
be used in future efficacy trials. Recruitment was limited to Puerto Rico, and thus results may not generalize to all Spanish-speaking BCS. Sleep efficiency was assessed with the PSQI rather than sleep diaries to enable group comparisons. Some participants were referred, which may have inflated acceptability rates, and the manual did not include relaxation training, as it was not included in the original protocol we translated. Strengths include initial pilot testing of a manualized, evidence-based intervention for an underserved population of cancer survivors and use of a randomized controlled design. This study used a priori acceptability and feasibility benchmarks and evaluated effect sizes to demonstrate proof-of-concept of the intervention’s clinical significance. Consistent with the ORBIT Model (Czajkowski et al., 2015), the next step is to test the efficacy of the Spanish-language CBT-I group intervention for BCS in a fully powered RCT.

**Author contributions** Conceptualization: BDG, JMC; Formal analysis: SLE; Resources: JS; Data curation: SLE, JDR, AIH. Writing-original draft: LBO, SLE, BDG. Writing-review & editing: all authors. Visualization: LBO, SLE. Funding acquisition: BDG, JMC.

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**Data, materials, and/or code availability** Data and code that support these findings are available from the corresponding author upon reasonable request.

**Declarations**

**Conflict of interest** Dr. Jim is a paid consultant for RedHill BioPharma, Janssen Scientific Affairs, and Merck, and receives research support from Kite Pharma. Dr. Gonzalez is a paid consultant for SureMed Compliance, KemPharm, Elly Health. The other authors have no relevant conflicts of interest.

**Ethical approval** All procedures were performed in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was approved by Advarra Institutional Review Board (Pro00034140).

**Human and animal rights and Informed Consent** All procedures followed were in accordance with ethical standards of the responsible committee on human experimentation (institutional and national) and
with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all individual participants in the study. Participants provided informed consent to publish anonymized data collected in this study.

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