Behavioral Treatments for Insomnia

Donna Arand, PhD, DABSM
Associate Research Professor
Wright State University Boonshoft School of Medicine, Dayton, OH
Prevalence, Impact & Co$t of Insomnia

- 10% of adults have chronic insomnia\textsuperscript{1,2}
- 15-20% of adults report short term insomnia\textsuperscript{1,2}
- 40-60% of adolescents have insomnia symptoms\textsuperscript{3}
- Insomnia and daytime effects contributory in 40% of collisions\textsuperscript{4}
- Auto accidents increased in insomnia (HR=1.2, 95% CI=1.0-1.45)\textsuperscript{4}
- 5 million visits to doctor generated by insomnia every year\textsuperscript{5}
- $63,607 additional cost of untreated insomnia per person per year\textsuperscript{6}

Cognitive behavior therapy (CBT) is recommended as the first-line of treatment for insomnia by the

- AASM\(^1\)
- American College of Physicians\(^2\)
- European Sleep Research Society\(^2\)

---

CBT-I Sessions

First Session
- Reviews problem & Sets Goals
- Describe program
- Sleep Education
- Questionnaires & Sleep diary

Intervention Sessions
- Sleep Hygiene
- Stimulus control
- Sleep restriction
- Relaxation Techniques
- Cognitive Therapy

Final Session
- Reviews interventions
- Relapse prevention
Behavioral Therapy in Children
Behavioral Intervention in Hospitalized Pediatrics

- **Purpose:** To examine the feasibility and acceptability of behavioral education and a breathing exercise intervention to increase sleep in hospitalized children.

- **Methods:** RCT
  - **Participants:** N=48 hospitalized children (ages 4-10), 2 groups
    - Relax to Sleep (RTS) (n=24); an education session for parent and booklet on training the child in use of diaphragmatic breathing exercises.
    - Usual Care (UC) n=24 received no information on sleep or relaxation.
  - **Measures:**
    - Actigraphy for 3 days and nights in children
    - Sleep diaries
    - Feasibility, acceptability and sleep outcomes

Papaconstantinou EA, Hodnett E, Stremier R. A Behavioral-Educational Intervention to Promote Pediatric Sleep During Hospitalization: A Pilot Randomized Controlled Trial, Behav Sleep Med, 2018. 16, 4, 36-370
Pediatric Sleep Following RTS and in Controls

Total Sleep Time at Follow-Up

<table>
<thead>
<tr>
<th>Total Sleep in minutes</th>
<th>Relax to Sleep</th>
<th>Usual Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>340</td>
<td></td>
<td></td>
</tr>
<tr>
<td>350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>360</td>
<td></td>
<td></td>
</tr>
<tr>
<td>370</td>
<td></td>
<td></td>
</tr>
<tr>
<td>380</td>
<td></td>
<td></td>
</tr>
<tr>
<td>390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>410</td>
<td></td>
<td></td>
</tr>
<tr>
<td>420</td>
<td></td>
<td></td>
</tr>
<tr>
<td>430</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WASO at Follow-Up

<table>
<thead>
<tr>
<th>WASO in Minutes</th>
<th>Relax to Sleep</th>
<th>Usual Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Papaconstantinou EA, Hodnett E, Stremier R. A Behavioral-Educational Intervention to Promote Pediatric Sleep During Hospitalization: A Pilot Randomized Controlled Trial, Behav Sleep Med, 2018. 16, 4, 36-370
Behavioral Intervention in Hospitalized Pediatrics

• **Results:**
  – RTS children averaged 50 min more nighttime sleep than UC
  – RTS children had 40 min less WASO than UC group
  – Parents reported that children found diaphragmatic breathing easy to use and would use it in the future
  – Parents indicated that they enjoyed the sleep discussion and the information was helpful

• **Conclusion:** Diaphragmatic breathing is a useful intervention to improve sleep in hospitalized children
Short- and Long-Term Effectiveness of CBT-I in Children

- **Purpose:** To evaluate short and long term effects of CBT-I in children and parents
- **Methods:**
  - **Participants:** 112 children (ages 5-10, 53%M) with chronic Insomnia (ICSD-2)
    - Sleep problems for mean of 4.9 yrs (.3-10 yr) and starting at age 3 ± 3.4
  - **Design:** RCT, 2 groups divided in 4:1 order
    - CBT-I (n=86 initially) however 67% dropout so reduced to n=27 by 12 mo
    - Waitlist control (WL) (n=26) however data loss reduced to n=11 (57%)
  - **Intervention for CBT-I:**
    - 3 100-min sessions each for children & parents separately; therapy puppet used to strengthen RX
    - Wk 1: avoid naps, bedtime delayed until sleepy, sleep hygiene explained, deep breathing taught
    - Wk 2: stimulus control, imagery metaphors, hypnotherapy (relax with sleep conducive image)
    - Wk 3: recapitulation, consolidation & stabilization of content & strategies used
  - **Measures:** baseline, post RX, 3, 6, 12 mos FU
    - Actigraphy 1 week (SOL, TST, # awakenings, SE)
    - Sleep diary for 2 weeks only 2nd week used
    - Children’s Sleep Habit Questionnaire (CSHQ-DE)

Post RX Effectiveness of CBT-I in Children

- **Results:**
  - **Post treatment**
    - 59% (51/86) in CBT-I no longer met criteria for insomnia
    - 41% (35/86) in CBT-I still met criteria for insomnia compared to 100% of WL
    - SOL, SE, # awakenings significantly improved in CBT-I group but not in WL
    - TST did not improve in either group
    - Parent-rated sleep on CSHQ-DE significantly improved in both groups
  - **Long Term Effectiveness (FU)**

Long-Term Effectiveness of CBT-I in Children

Long Term Effectiveness of CBT-I in Children

% Children with Insomnia after CBT-I

Long-Term Effectiveness of CBT-I in Children

• **Results:**
  – CBT-I had greater improvement after treatment compared to the WL on actigraphy and subjective measures
  – Improvements persisted over 3, 6, and 12 months

• **Conclusion:** CBT-I shows short and long term effectiveness in school-age children with chronic insomnia.
Behavioral Treatment of Insomnia in Adults
CBT for Older Adults with Insomnia and Depression

**Purpose:** To determine if CBT-I is effective for older adults with comorbid insomnia and depression and also to compare CBT-I to CBT-I plus mood strategies (CBT-I+).

**Methods:**
- Participants: n=72 (56% F, age 75 ±7) with comorbid insomnia & depression
- Design: RCT, 3 groups
  - CBT-I
  - CBT-I+ mood strategies (e.g. activity scheduling, cognitive reframing, thought diary)
  - Psychoeducation control
- Procedure
  - 8-weeks with a 60-90 min group session in community mental health services
- Measures: at pre, post & FU (weeks 0, 8, 20 respectively)
  - ISI
  - Geriatric Depression Scale

Paul Sadler, Suzanne McLaren, Britt Klein, Jack Harvey, Megan Jenkins; Cognitive behavior therapy for older adults with insomnia and depression: a randomized controlled trial in community mental health services, *Sleep*, Volume 41, Issue 8, 1 August 2018
CBT-I in Insomnia & Depression

Insomnia Severity Index

Depression Severity

Paul Sadler, Suzanne McLaren, Britt Klein, Jack Harvey, Megan Jenkins; Cognitive behavior therapy for older adults with insomnia and depression: a randomized controlled trial in community mental health services, *Sleep*, Volume 41, Issue 8, 1 August 2018
CBT-I and Depression

• Results:
  – CBT-I and CBT-I+ both showed significantly greater reduction in insomnia and depression severity compared to PCG control
  – Large effects sizes, high retention and strong remission rates
  – Results were maintained at follow-up

• Conclusion: CBT-I, and CBTI+ were both effective in reducing insomnia and depression severity in older adults.

Paul Sadler, Suzanne McLaren, Britt Klein, Jack Harvey, Megan Jenkins; Cognitive behavior therapy for older adults with insomnia and depression: a randomized controlled trial in community mental health services, Sleep, Volume 41, Issue 8, 1 August 2018
CBT-I & CPAP Use

**Purpose:** To determine if initial treatment with CBT-I compared to treatment as usual (TAU) improves insomnia and increases CPAP use

**Method:** RCT
- **Participants:** n=145, age 18-75 (mean=59) with insomnia and OSA (AHI >15)
- **Design:** 2 groups, CBT-I+CPAP or TAU+CPAP
- **Procedure:** CBT-I had 4-weekly 45-min CBT-I session before CPAP that included
  - *sleep restriction*
  - *cognitive therapy*
  - *sleep hygiene & sleep info*
  - *review & relapse prevention*

**Measures:** baseline, 6 wk, 3m, 6m
- Primary outcomes - CPAP adherence & objective SE at 6 mo
- PSG and diary measured SE, TST, SOL, WASO
- ISI, CPAP acceptance/rejection

Cognitive and behavioral therapy for insomnia increases the use of continuous positive airway pressure therapy in obstructive sleep apnea participants with comorbid insomnia: a randomized clinical trial, *Sleep*, 42 (12), 2019, zsz178, https://doi.org/10.1093/sleep/zsz178
Cognitive and behavioral therapy for insomnia increases the use of continuous positive airway pressure therapy in obstructive sleep apnea participants with comorbid insomnia: a randomized clinical trial, *Sleep*, 42 (12), 2019, zsz178, https://doi.org/10.1093/sleep/zsz178
CBT-I and CPAP use

• **Results:**
  – CBT-I group had 61 min more CPAP use than TAU at 6mo
  – CBT-I had greater improvement in ISI at 6 wks
  – CBT-I had higher initial CPAP acceptance (99% vs 89%)
  – No difference in daytime impairment, SOL, SE, WASO, TST between groups at 6 mos PSG

• **Conclusion:** CBT-I prior to initiating CPAP improves CPAP use and insomnia compared to CPAP only.
Digital Delivery of CBT-I
Short Term Efficacy of Unguided Internet Based CBT-I

• Purpose: To evaluate the short-term efficacy of an unguided internet-based CBT-I program called SHUTi in Norwegians

• Methods:
  – Participants: n=181, mean age 45, (67% m) with insomnia
  – Design: RCT; 2 groups
    • SHUTi group (n=95) 6 cores accessed 1 wk apart
    • Web based Education condition (n=86)
  – Measures: (online)2 wk diary, 9 wk intervention, 2wk diary and 6m for SHUTi only
    • ISI
    • Bergen Insomnia Scale (BIS) 6 items 0-7 scale

Hagatun S, Vedaa O, Nordgreen Tm Smith, O, Pallesen S, Havik O et al. The Short-Term Efficacy of an Unguided Internet-Based Cognitive-Behavioral Therapy for Insomnia: A Randomized Controlled Trial With a Six-Month Nonrandomized Follow-Up. Behav Sleep Med 2019, 17,2, 137-155
Results of Unguided Internet-Based CBT-I

BIS and ISI Scores for SHUTi Group

Hagatun S, Vedaa O, Nordgreen Tm Smith, O, Pallesen S, Havik O et al. The Short-Term Efficacy of an Unguided Internet-Based Cognitive-Behavioral Therapy for Insomnia: A Randomized Controlled Trial With a Six-Month Nonrandomized Follow-Up. Behav Sleep Med 2019, 17,2, 137-155
Unguided Internet Based CBT-I

• Results:
  – SHUTi group had significant decrease in ISI and BIS at post assessment compared to baseline
  – SHUTi group had significant difference on ISI (d = -1.77) and BIS (d = -1.0) compared to control
  – Participants completing SHUTi maintained improvements at 6 mo
  – Dropout attrition was high
    • 19% at post RX (9wks) for SHUTi (77/95)
    • 24% at post test (9wks) for controls 65/86
    • 58% at 6 mo in SHUTi (n=40/95)

• Conclusion: Unguided Internet based CBT-I produced significant short-term improvements in insomnia patients and maintained at 6 mo. A FU study showed all improvements maintained at 18 mo.¹

Effect of Digital CBT-I on Health, Well-being and Quality of Life

• **Purpose:** To determine if digital CBT-I improves health, psychological well-being and quality of life and if a reduction in insomnia symptoms was a mediating factor

• **Methods:**
  - **Participants:** 1711 volunteers (78%F, age 48+13.8) with self-reported insomnia (DSM-5)
  - **Design:** RCT, 2 groups,
    - dCBT-I (n=853) - Sleepio program of 6 sessions, 20-min each with 12wk access + TAU
    - SHE- group (n=858) - a web page and downloadable booklet in 1 session + TAU
  - **Measures:** online assessment at 0, 4, 8 (post RX) and 24 (FU) wk
    - Global Health Scale
    - Glasgow Sleep Impact Index
    - Quality of Life (QOL)
    - Sleep Condition Indicator (SCI) of insomnia
    - psychological well-being
    - Secondary outcomes: mood, fatigue, sleepiness, cognitive failure, work productivity

Effect of Digital CBT-I on Health, Well-being and Quality of Life

• **Results:**
  – 81% dCBT logged for on at least 1 session and 48% completed 6 sessions.
  – 89% of SHE accessed website at least once
  – dCBT group had significant improvement in global health, mental well-being, and QOL at 4, 8, 24 wks compared to SHE
  – Depression, anxiety, sleepiness and cognitive failures showed significant improvement at 4, 8 and 24 wks in the dCBT group compared to SHE
  – Sleep condition indicator (SCI) significantly improved in dCBT compared to SHE
  – A large improvement in insomnia mediated outcomes (range 45.5-84%)

• **Conclusions:**
  – dCBT is effective in improving health, psychological well-being, and QOL in people reporting insomnia symptoms
  – A reduction in insomnia symptoms mediated the improvements
Comparative Studies of CBT-I and Other Interventions
Aerobic Exercise vs CBT-I in Cancer Patients with Insomnia

- **Objective:** Access the efficacy of 6-week home based aerobic exercise program (EX) compared to 6-week self-administered CBT-I

- **Method:**
  - Participants: 41 patients (78% F, mean age 57) with various types of Cancer and insomnia (ISI>8)
  - Design: randomized controlled trial, 2 groups
    - Exercise (EX) (n=20)
    - CBT (n=21)
  - Measures: pre- and post-treatment, 3 and 6 mo FU
    - ISI
    - PSQI
    - sleep diaries (SOL, WASO, TWT and SE)
    - actigraphy

Exercise vs CBT-I in Cancer Patients

Exercise vs CBT-I in Cancer Patients

Mercier J, Ivers H, Savard J. A non-inferiority randomized controlled trial comparing a home-based aerobic exercise program to a self administered CBT-I in cancer patients. Sleep 2018, Jul 25
Exercise vs CBT-I in Cancer Patients

• **Results**
  – Exercise and CBT-I significantly improved ISI, PSQI and most sleep diary parameters at FU
  – Objective actigraphy data did not significantly differ between groups
  – General persistence of sleep difficulties in CBT-I and EX with remission rates of 30% and 35% respectively post treatment and at follow-up

• **Conclusions:**
  – Exercise and CBT-I significantly improved sleep in CA-related insomnia

Acupuncture vs CBT-I in Cancer Survivors

• **Purpose**: To determine the comparative effectiveness of acupuncture (AP) and CBT-I for insomnia in cancer survivors

• **Methods**:
  – **Participants**: 160 cancer survivors, (mean age 62, 54%F) ISI>7
  – **Design**: RCT, 2 parallel groups
    • CBT-I (n=80)
    • Acupuncture (n=80)
  – **Procedures**: 8 weeks of acupuncture or CBT-I
  – **Measures**: at baseline, 8, 12, 16, 20 wks. Others measures at base, 8 and 20 wks
    • ISI, Sleep Diary, Fatigue Inventory Short Form
    • PSQI, Brief Pain Inventory, Hospital Anxiety and Depression Scale
    • Patient-Reported Outcomes Measurement Information System Global Health Scale

Acupuncture vs CBT-I in Cancer Survivors

Acupuncture vs CBT-I in Cancer Survivors

Decrease in Sleep Onset Latency

- CBT-I
- Acupuncture

Decrease in Sleep Onset Latency

<table>
<thead>
<tr>
<th></th>
<th>8 wks</th>
<th>20 wks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBT-I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acupuncture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Change in WASO

<table>
<thead>
<tr>
<th></th>
<th>8 wks</th>
<th>20 wks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBT-I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acupuncture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Increase in Total Sleep Time

<table>
<thead>
<tr>
<th></th>
<th>8 wks</th>
<th>20 wks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBT-I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acupuncture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Acupuncture vs CBT-I in Cancer Survivors

• **Results:**
  – CBT-I & AP had significant reduction in ISI, but greater with CBT-I
  – CBT-I and AP both reduced ISI by 8 points, clinically meaningful
  – CBT-I more effective than AP for improving PSQI, SOL, WASO
  – ISI improvement maintained at 20 weeks for both groups
  – Acupuncture was more effective in increasing TST
  – Both groups had similar improvement in fatigue, anxiety, depression and QOL

• **Conclusion:** Both acupuncture and CBT-I produced clinically meaningful reductions in insomnia, however CBT-I was more effective overall.
Comparative Treatments for Insomnia with Hot Flashes

• **Purpose:** Assess interventions for insomnia in women with vasomotor symptoms (VMS)

• **Method:**
  
  – **Design:** Pooled data from 4 RCT, n=546 peri and postmenopausal F with ISI \( \geq 12, \geq 14 \) VMS/week
  
  – **Interventions:** yoga, aerobic exercise, 1.8g/d omega 3 fatty acids, 17-beta estradiol 0.5mg.d, venlafaxine XR 75mg.d, escitalopram 10-20 mg/d and CBT-I
  
  – **Measures:** at baseline, 4 wk, 8 wk, some at 12 wk
    
    • ISI
    • PSQI
Comparative Treatments for Insomnia with Hot Flashes

Guthrie KA, et al. *Sleep*, Volume 41, Issue 1, 1 January 2018, zsx190. Effects of Pharmacologic and Nonpharmacologic Interventions on Insomnia Symptoms and Self-reported Sleep Quality in Women With Hot Flashes: A Pooled Analysis of Individual Participant Data From Four MsFLASH Trials
Comparative Treatments for Insomnia with Hot Flashes

• **Results:**
  - CBT-I produced the greatest reduction in ISI from baseline compared to controls -5.2 points (95% CI -7.0 to -3.4)
  - Exercise and venlafaxine had similar effects on ISI (-2.1 and -2.3)
  - CBT-I produced the largest improvements in PSQI of -2.7 points (-3.9 to -1.5)
  - Yoga, exercise, estradiol, venlafaxine and escitalopram produced significant decrease of 1.2-1.6 points on PSQI compared to controls
  - Omega-3 supplements did not improve insomnia symptoms

* **Conclusion:** CBT-I is recommended as a first line treatment in healthy midlife women with insomnia symptoms and moderately bothersome VMS.
Unique Behavioral Interventions
Effect of Passive Body Heating on Sleep

• **Purpose:** To determine if warm shower or bath before bedtime improves sleep

• **Methods:** Systematic review and meta-analysis
  – **Databases:** PubMed, CINCAHL, Cochran, Medline, PsycInfo, Web of Science
  – 13 studies with comparable quantitative data
  – **Measures:**
    • SOL, TST, SE
    • self-reported sleep quality

Passive Body Heating Before Bedtime

• **Results:**
  – Passive body heating in 104-109° F water improved self-reported SE and sleep quality
  – When scheduled 1-2 h before bedtime for as little as 10 min, it significantly shortened sleep latency by 10 min
  – Optimal timing of bath was 90 min before bed time

• **Conclusion:**
  – Warm baths 1-2 hours before bed will increase the chance of falling asleep quickly and result in better quality sleep
Forehead Cooling in Hot Flashes

• **Purpose:** To explore efficacy of forehead cooling for sleep difficulties and hot flashes in menopause

• **Method:**
  – **Participants:** 20 women (19 post menopausal) with insomnia and ≥ 2 hot flashes per day
  – **Procedure:** sleep diaries + #hot flashes, baseline and during 4 wks with nightly use of forehead cooling (15-18°C) using Ebb CoolDrift Luxe device

Forehead Cooling in Hot Flashes

Forehead Cooling in Hot Flashes

• **Results:**
  – Forehead cooling significantly improved SOL & WASO
  – Forehead cooling significantly improved hot flash severity

• **Conclusion:** Nightly use of forehead cooling results in improved sleep and a reduction in insomnia, hot flashes and other menopausal symptoms
Weighted Blankets and Insomnia

• **Purpose:** To evaluate the effect of weighted chain blanket (WCB) on insomnia and daytime symptoms in psychiatric disorders

• **Methods:**
  – **Participants:** n= 120, with bipolar, depressive disorder, anxiety disorder or ADHD
  – **Design:** RCT, 2 groups,
    • weighted chain blanket (WCB)
    • light plastic chain blanket
  – **Procedure:** Used WCB or light chain blanket for 4 weeks, then all switched to WCB till 12 mo FU
  – **Measures:** at baseline, 1-4 wk treatment and 12 mo FU
    • ISI * Fatigue Symptom Inventory
    • Sleep Diaries * Hospital Anxiety and Depression scale

Weighted Blankets and Insomnia

Weighted Blankets and Insomnia

• **Results:**
  – Weighted Blanket produced a significant and large improvement on ISI
  – Effects maintained at 12 mo follow-up
  – Patients switching to weighted blanketed had similar reduction in ISI at 12 mo
  – WCB also resulted in significantly reduced fatigue, depression and anxiety

• **Conclusion:** Weighted chain blankets are effective & safe for improving insomnia in patients with psychiatric disorders
Effect of Tai Chi on Sleep Quality in Major Depressive Disorder

• **Purpose:** To evaluate the effects of Tai Chi training on sleep quality, depression & social functioning in patients with depression (MDD).

• **Methods:**
  – **Participants:** 16 depressed Chinese Americans (age 54±11, 10F)
  – **Intervention:** 1-hr Tai Chi training sessions twice per wk for 10 wk
  – **Measures:** testing at baseline and 10 wks
    • PSQI
    • Beck Depression Scale
    • Hamilton Rating Scale for Depression (HAM-D)
    • Short form Health Survey
    • 24 hr ECG recording for determining objective sleep from cardiopulmonary coupling analysis of ECG

Effects of Tai Chi on Depression and Insomnia

Tai Chi Effects on Sleep in Major Depression

• **Results:**
  – PSQI significantly improved
  – SOL significantly decreased
  – Significantly decreased Hamilton Depression Scale
  – Significantly decreased Beck Depression Scale
  – Significant correlations between changes in PSQI and HAM-D (r=.6) as well as PSQI and BDI (r=.62)
  – No correlations between objective sleep measures & depression

• **Conclusion:** Tai Chi training improved sleep quality and mood symptoms among depressed patients.
Behavioral Sleep
the Otter Way