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The Efficacy of Short-term Group Cognitive-Behavioral Therapy in the Treatment of Insomnia in the Severely and Persistently Mentally Ill

by

JESSICA MITCHELL

A dissertation submitted to the Graduate Faculty in Psychology
In partial fulfillment of the requirements for the degree of
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Abstract

The Efficacy of Short-term Group Cognitive-Behavioral Therapy in the Treatment of Insomnia in the Severely and Persistently Mentally Ill

by

Jessica Mitchell

Advisor: Professor Arthur Spielman

Study Objectives: To assess the efficacy of short-term group cognitive-behavioral treatment (CBT) of insomnia in a chronic psychiatric population. The study objective was to assess the effects of CBT on sleep parameters and daytime symptoms compared to a stress treatment group (STG) and wait list control (WLC) conditions.

Design: Matched assignment to one of three conditions.

Setting: A psychiatric out-patient setting.

Patients: Forty-one out-patient subjects who met criteria of a = or > 30 minute sleep latency and sleep efficiency < 85%.

Interventions: Multi-component CBT, utilized stimulus control, modified sleep restriction, relaxation techniques, behavioral-cognitive strategies, sleep hygiene, and sleep education. STG utilized supportive therapy and emotional expression of current psycho-social problems.

Measurements: Data from subjective (sleep diary) measures are analyzed by means of General Linear Model 3 x 4 repeated measures analyses of variance (ANOVAs). A priori orthogonal contrasts and post hoc Tukey HSD multiple comparisons were conducted. The

outcome measures were analyzed using a 3 x 2 repeated measures ANOVAs, with the 3 groups as the between-subjects factor and the 2 evaluations (pre and post-treatment) as the within-subjects factor. A priori orthogonal contrasts were done to identify differences between the treatment groups. Post hoc Tukey HSD comparisons were done to identify possible differences between the groups at each evaluation period.

Results: The CBT group produced larger improvements across the majority of outcome measures than the STG or the WLC group. Self-report measures of sleep onset latency, total wake time, number of awakenings, nap time, and time in bed, showed significant change with treatment. Post-treatment gains on most measures were maintained at Week 10.

Conclusions: Results provide evidence from a controlled trial that CBT improves insomnia in a psychiatric population with diagnoses of schizophrenia, schizoaffective, and bipolar disorder. As hypothesized, participants in the CBT condition showed significant improvements on many sleep parameters, while those participants in the STG and WLC groups showed few changes.

Key words: Insomnia, group treatment, multi-component treatment, cognitive-behavioral treatment, psychiatric population, chronic mental illness.

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Introduction

Insomnia is common in the chronically mentally ill and can exacerbate psychiatric symptoms,[1, 2] influence availability for treatment, and interfere with medication compliance.[3-7] However, individuals with psychiatric disorders are often excluded from research studies of insomnia treatment. Studies have explored the value of behavioral interventions either alone[9] or in association with pharmacotherapy,[8] for inpatient management of insomnia in psychiatric patients. None of these studies, to our knowledge, have focused on the efficacy of behavioral management for chronic insomnia in outpatients with chronic mental illness. Because the mentally ill are often seen for long-term follow-up in day hospital and out patient clinics, the opportunity exists within these settings to work with patients on sleep hygiene, which may improve overall level of functioning in this population.[1, 7]

The current study is intended to assess the value of out-patient group treatment in the persistently mentally ill for the management of chronic insomnia, to evaluate the impact on psychiatric symptomatology (to be reported elsewhere) and quality of life. Patients were assigned to one of two active treatments, Cognitive Behavioral Therapy, Stress Treatment Group, or placed in a Wait List Control group.

Methods

Participants

Forty-eight subjects (26 men, 22 women), average age 37.4 years (*SD* = 10.1 years) were recruited from the patient population of the Integrated Psychiatric Services at St. Luke's/Roosevelt Hospital, New York, NY. Within 2 weeks of starting the study, 7 subjects (5 men, 2 women) were dropped from participation. The reasons for dropout were refusal to report sleep (*n* =4), left the country (*n* =1), nonparticipation and pregnancy (*n* =1), and re-hospitalization (*n* =1). The final group consisted of 41 subjects, 23 men, 18 women, with an average age 37.4 years (*SD* = 10.1 years). Subjects were randomly assigned to one of three groups, Wait List Control (WLC; *n* = 13), Stress Treatment Group (STG; *n* = 14), Cognitive Behavioral Therapy (CBT; *n* = 14) with a subsequent attempt made to match the groups on sex, age, diagnosis, substance abuse history, and medication use (see Tables 1 and 2 for group assignment by gender, diagnosis and medications prescribed).

The 41 subjects completing the study had a current Axis I diagnosis of schizophrenia (n=15), schizoaffective disorder (n=24) or bipolar disorder (n=2), based on a clinical interview conducted by a staff psychiatrist.[9] All candidates were being seen for outpatient medication and case management and had been discharged from the hospital at least one month before the study began.

Subjects were all receiving medication(s), which remained stable throughout the study. The typical neuroleptics used were: Haloperidol (Haldol), (n=15), Fluphenazine (Prolixin), (n=3), Chlorpromazine (Thorazine), (n=2), Thiothixine (Navane), (n=2), Molindone (Moban), (n=1), Perphenazine (Trilafon), (n=2), and Thioridazine (Mellaril), (n=1). The atypical neuroleptics

prescribed to subjects were, Olanzapine (Zyprexa), (n=17), Resperdol (Resperidol), (n=5), and Clozapine (Clozaril), (n=1).

Subjects with a history of substance abuse (n=18) were required to be 6 months free of drugs of abuse, and were subject to random drug screening by urinalysis throughout the study Tests confirmed that subjects remained free of drugs of abuse throughout the study.

Individuals were excluded from participation if any of the following were found or reported: (a) current use of hypnotics; (b) active substance abuse; (c) a history suggestive of obstructive sleep-apnea syndrome or restless leg syndrome; (d) a history suggestive of chronic pain or gastroesophageal reflux; (e) unstable medical condition; and (f) inability to report sleep log data.

Based on a sleep questionnaire and interview individuals were eligible for the study if they reported either a sleep efficiency (SE, sleep duration/time in bed x 100%) of less than 85% or a sleep latency (SL) of least 30 minutes for at least six months. The SE% and/or SL criteria were confirmed by one week of sleep logs in all subjects prior to the study. All subjects were classified as Insomnia Associated with Psychopathology and Insomnia Related to Another Mental Disorder based on the International Classification of Sleep Disorders (ASDA, 1990) and the DSM-IV respectively.[9, 10]

Candidates who met the inclusion and exclusion criteria were asked to participate in a 6 week study of the efficacy of short-term group therapy for insomnia. The research protocol was described, verbally and in writing, and informed consent was obtained. The study was approved by the Institutional Review Boards of St. Luke's/Roosevelt Hospital and The City College of The City University of New York. Potential subjects were asked to participate in a research

study of non-drug treatment for insomnia. They were told that the study is designed to determine the effectiveness of various group treatments for the management of insomnia.

Subjects were initially assigned randomly to one of the three groups (CBT, STG, or WLC). After this initial assignment one of us (AJS) who was unacquainted with any of the candidates reassigned subjects so that the groups would be better matched on the basis of age, medication use, and diagnosis. When two potential participants withdrew, a second level of assignment occurred.

Measures

The following instruments were administered to subjects:

The Sleep Impairment Index (SII);[4] is a seven-item questionnaire that yields a qualitative index of sleep impairment and treatment outcome. Participants were asked to rate the following components on a 5-point Likert scale ranging from (not at all) to 5 (extremely): (a) severity of sleep-onset, sleep maintenance, and early morning awakening problems; (b) satisfaction with current sleep pattern; (c) interference with daily functioning; (d) noticeable impairment attributed to the sleep problem; and (e) level of distress caused by the sleep problem. Total scores range from 0 to 28; higher scores indicate higher perceived insomnia severity.

The Beliefs and Attitudes Sleep Scale (BAS) [4] is a 30-item scale tapping sleep-related cognitions. Five theoretical factors are studied: misattribution or amplifications of the consequences of insomnia, control and predictability of sleep; unrealistic sleep expectations; misconceptions about the causes of insomnia, and faulty beliefs about sleep-promoting practices. Participants rated their level of agreement or disagreement on a visual analog scale ranging from 0 (strongly disagree) to 10 (strongly agree). A higher score is associated with a greater level of dysfunctional cognitions.

The Beck Depression Inventory[11] and Symptom Check List (SCL-90-R) [12] were used to evaluate psychiatric symptoms and to document changes in symptomatology following the insomnia treatment.

The Quality of Life Inventory[13] is a 31-item scale, with questions related to sleep, cognitive functioning, daytime performance, social and family relationships, and health. Participants were asked to respond to most items on a five-point scale ranging from 0, (not at all/never), to 4, (very much/always).

A Sleep Questionnaire, designed by our laboratory is comprised of 50 items and was completed at the time of the evaluation. This questionnaire was used to assess the symptoms of various sleep pathologies.

A sleep diary was filled out each day and yielded the following measures: (a) Sleep efficiency% (SE) this ratio is derived by dividing total sleep time (TST) by time in bed (TIB) and multiplying by a 100%. (b) Sleep-onset latency (SL) was defined as the time from lights out to sleep onset, (c) (TIB) is defined as the total time elapsed from initial lights out to the final arising time. (d) (TST) subjective reported sleep duration. (e) Total wake time (TWT) the length of reported TIB awake including (SL).

Procedures

The screening phase entailed the collection of demographic data, a symptom report, duration of sleep complaint, and information regarding medical, psychiatric, and sleep history. Respondents who met inclusion/exclusion criteria were invited to enter the study. Subjects were asked to attend a series of six weekly group treatment meetings or remain on a waiting list.

Baseline sleep log data consists of two weeks, one week during the screening phase and one week prior to starting treatment. During treatment, sleep log data was analyzed for week 4 and at week 6. Short-term follow-up was assessed at Week10, 4 weeks after the end of treatment. The cognitive limitations of many participants necessitated oral collection of sleep log data and oral administration of pre/post data by the principle investigator and research assistants. The primary

investigator collected data on a daily basis, during weekdays, collecting weekend data each Monday, from all study participants. The primary investigator also assisted the co-investigators in the collection of pre/post-treatment assessment measure data, collecting data for total of nine subjects, across the two post-assessment time periods. Care was taken to obscure the treatment group identity from co-investigators during the post treatment assessment period.

The following measures were collected prior to treatment and following the last treatment session; Beck Depression Inventory, SCL-90-R, Sleep Impairment Index, the Beliefs and Attitudes Sleep Scale, and Quality of Life Inventory.

Statistical Analyses

Measures of central tendency are given as mean $\pm$ standard deviation, unless otherwise stated. Changes over time as a function of treatment group are tested by 3x4 repeated measures ANOVA, with post-hoc Tukey tests for group differences at each time of measurement. Orthogonal contrasts were computed [24] to test whether (1) the two treatment groups, CBT and STG, taken together, differed overall from the WLC control group; and (2) whether the CBT group differed overall from the STG group. In general, parametric tests are used except where the assumption of homogeneity of variance is violated; in that case, a nonparametric test such as the Kruskal-Wallis ANOVA is used instead.

Data for each primary sleep diary measure was analyzed by means of General Linear Model 3 x 4 repeated measures analyses of variance (ANOVAs). Group assignment (CBT, STG, and WLC) was treated as the between-group factor and time, the within group factor, was regarded as a repeated measure (baseline, Week 4, Week 6, and post treatment or Week 10). A priori orthogonal contrasts and post hoc Tukey HSD multiple comparisons were conducted.

The outcome measures were analyzed using a 3 x 2 repeated measures ANOVA, with the 3 groups as the between-subjects factor and the 2 evaluations (pre and post treatment) as the within-

subjects factor. Post hoc Tukey HSD comparisons were done to identify possible differences between the groups at each evaluation period.

Interventions

The treatments were conducted in a group setting, restricted to 8 participants per group. The study was conducted at two time periods with approximately half of the subjects participating in each segment of this study with the same therapist (JM). The two treatment groups, CBT and STG, met for sessions on consecutive days, at the same hour, with the same therapist. Treatment took take place within the case management site. The participant(s) reported sleep log data throughout the six week treatment period.

Cognitive Behavioral Treatment Group (CBT)

The CBT group received instruction in stimulus control, sleep restriction, cognitive strategies, sleep hygiene, and basic sleep education.[4, 15] The efficacy of both stimulus control and sleep restriction therapy is widely documented.[3, 15] In addition, relaxation strategies, were also provided.[16, 17]

The objective of stimulus control instruction was to help the participant to learn to fall asleep quickly and subsequently maintain sleep by strengthening both bed and bedtime as cues for sleep rather than as a stimuli for arousal and/or activities that might interfere with sleep. Instructions were: (1) go to bed only when sleepy, (2) use the bed and bedroom only for sleep and sex (i.e., not listening to the radio, reading, television watching, eating, or working in bed during the day or at night), (3) get out of bed and go into another room whenever you are unable to fall asleep or go back to sleep after 15-20 minutes, and return only when sleepy again, (4) maintain the same waketime regardless of the amount of sleep during the previous night, and (5) avoid napping.[18]

A modified or graduated version of sleep restriction therapy was offered to the treatment group that took into consideration the importance of avoiding excessive demands that could lead to increased anxiety and stress, which might result in subsequent non-compliance. The need for

gradual change was supported by positive reinforcement and the consideration of each individual's capacity to cope with anticipatory anxiety. Patients were asked to shorten their time in bed by no more than one hour in any one week period. Patients were offered additional telephone support between sessions when making these adjustments, upon request, following the original treatment model.[19, 20]

Relaxation strategies[4, 17, 21] included the selective use of progressive muscle relaxation, the tensing and relaxing of muscles; guided visual imagery, the imaging of a neutral, pleasing image; and calming counts, utilized to reduce obsessive thoughts and distract from external stimuli.

The sleep hygiene component[4] of CBT entailed describing the effects on sleep of various stimuli such as caffeine, nicotine, alcohol, exercise, diet, noise, light, and temperature. The educational component explained basic facts about the nature of sleep, sleep staging, arousals, and sleep changes experienced across the lifespan.

The cognitive therapeutic component was modeled after the work of Beck and Meichenbaum [22, 23] and adapted to work with insomnia patients by Lacks and Morin.[4, 24] Work consisted of cognitive restructuring techniques aimed at altering dysfunctional beliefs and attitudes about sleep. A three-step process was followed for achieving goals: (1) identification of patient-specific dysfunctional cognitions; (2) confrontation and challenge of their validity; and (3) replacement with more adaptive and rational alternatives. [22, 23]

The agenda for each therapy session consisted of: a review of sleep diary material, discussion of personal monitoring strategies, and a review of progress during the preceding week; the discussion of strategies for solving difficulties incurred in implementing treatment procedures; and the introduction of a new therapy component and its purpose[4] (see Table 3).

Stress Treatment Group (STG)

The Stress Treatment Group participated in a six week structured group experience. STG utilized supportive therapy and emotional expression of current psycho-social problems.

This group offered an opportunity for participants to talk about their current life stressors, medical and psychiatric problems, including insomnia, and receive support, validation, and an opportunity to discuss problem solving strategies. The group was lead by a therapist (JM), experienced in small group work (see Table 4).

Waiting List Control (WLC)

The Wait List Control was told that they were waiting to be assigned to a treatment group. Throughout the ten week duration of the study, including the post-treatment assessment, WLC subjects completed the same daily sleep logs for each assessment time point, pre and post-treatment assessments as the CBT and STG participants (see Table 5).

Results

Tables 1 and 2 summarize demographic and clinical characteristics of the 41 subjects who completed the protocol. Post hoc Tukeys confirm that the three groups were equivalent at baseline on all primary and secondary dependent variables, including sleep diary measures, sleep, quality of life and cognitive questionnaires (SII, QOL, and the BAS), as well as the depressive scale (BDI).

Data for each primary sleep diary measure (Figure 1 and Table 6 and 7) was analyzed by means of General Linear Model 3 x 4 repeated measures analyses of variance (ANOVAs). Group assignment (CBT, STG, and WLC) was treated as the between-group factor and time was regarded as a within subjects repeated measure (baseline, Week 4, Week 6, and post-treatment Week 10). The homogeneity of variance between groups (sphericity assumption) was evaluated by Mauchly's criterion, *W*. As the sphericity assumption was violated for nearly all variables and is of dubious validity for the remainder, and as many measures are derived from one another, the Huynh-Feldt epsilon *p* values are reported for all variables. Planned orthogonal contrasts were employed to compare performance differences between groups. Since the sphericity assumption is violated for most variables, Welch's P adjusted the degrees of freedom were used to provide an unbiased and more conservative estimate of significance in all cases for these contrasts. Post hoc Tukey HSD multiple comparisons were also conducted, maintaining the experiment-wise alpha = .05.[14]

The pretreatment and post-treatment outcome measures (Figure 2) were analyzed by means of 3 x 2 (group assignment x time [pre and post-treatment period]) by analysis of variance (ANOVAs) and post hoc Tukey HSD comparisons. Note: as pre/post measures have only two levels for time, sphericity tests are not required and all *p* values given are from the *F* test.

Sleep Latency (SL)

Throughout the course of the study there was little change in SL (Group, $F(2, 38) = 1.80$, NS); Time (Time, $F(3, 114) = 2.43$, NS). However, there was a reliable Group x Time interaction, ($F(6, 114) = 3.23, p = .006$) due to the marked decline in SL in the CBT treatment group between baseline (66.9 min) and Week 4 (42.1 min). The SL in the CBT group continued to be reduced at Week 6 and 10. Planned orthogonal comparisons between the two treatment groups (CBT and STG) and the control group (WLC) showed no significant difference. The decrease in SL in the CBT group during treatment was not quite large enough to achieve significance in comparison to the STG group ($p = .06$). However, the post-hoc Tukey HSD tests found a significant difference ($p = .03$) between these two groups at the end of treatment (Week 6). Sleep latency for CBT participants by the end of treatment (Week 6) was reduced by an average of 31.3 min from baseline. The STG reduction, for Week 6 was 5.33 min.

Total Wake Time (TWT)

The CBT group reduction of TWT by almost 50.0 min was achieved by Week 4 ($p < 0.1$) and persisted through the follow-up period. TWT in the STG group remained essentially constant from baseline to one month follow-up, averaging over 2 hours per night. The WLC showed a slight decrease in TWT over time, with the only significant reduction occurring at Week 6.

There was a significant main effect for Group (Group, $F(2, 38) = 2.80, p = .01$) as well as for Time (Time, $F(3, 114)$ 6.41, $p = .001$). There was also a significant Group x Time interaction ($F(6, 114) = 4.36, p = .05$). Planned orthogonal comparisons between the two treatment groups (CBT, STG) and the control group (WLC) showed no significant differences overall. However, a specific contrast between the CBT and the STG groups was significant ($t(38) = -3.247, p = .0025$, one-tailed). Post hoc Tukey HSD tests showed a mean difference between CBT and STG groups at Week 6 and 10 and between WLC and STG at Week 6.

Number of Awakenings

On the variable number of awakenings there was a main effect for Group (Group, $F(2, 38) = 5.75, p = .007$) due to fewer awakenings in the CBT group throughout the study. There was also

a significant effect of Time (Time, $F(3,114) = 4.57, p = .01$). The Group x Time interaction was NS. The planned orthogonal comparison found a significant difference between the CBT and the STG groups ($t(38) = -3.107, p = .0028$ one-tailed). The CBT group awakened reliably less often than the other two groups at Week 4, Week 6 and Week 10 (post hoc Tukey HSD ($p = .05$).

Nap Time

This group of psychiatric outpatients evidenced a pattern of consistent and frequent napping. Overall, the sample averaged 46 min of nap time in the WLC and 18 to 20 min in the STG and CBT groups. The WLC control group did not decrease their naptime reliably over the 10 weeks of the study, but the other two groups reduced their daytime sleep significantly ($t(38) = -2.552, p = .01$, one-tailed). The nap time for CBT participants at the end of treatment (Week 6) was reduced by an average of 39.2 min from baseline. The STG and CBT groups did not differ from each other over the course of treatment (see Figure 1).

Because of the higher mean nap time in the WLC group, the 3 x 4 ANOVA found a significant main effect of Group (Group, $F(2, 38) = 3.26, p < .05$). The decreased nap time in the two treatment groups over time was reflected in the significant finding for the main effect of Time (Time, $F(3, 114) = 5.59, p = .01$), and in the a Group x Time interaction $F(6, 114) = 2.72, p = .05$. By the end of treatment, the multiple comparison Tukey tests found significant differences in nap time between the WLC and each of the two treatment groups at the ($p < .01$) level.

Time in Bed (TIB)

The study sample, taken as a whole, spent a lot of TIB, ranging from 588 min to 613 minutes. The groups did not differ at baseline. The WLC and STG groups are very close in value across all points in time. They evidence minor decrease in time in bed, approximately 30 - 40 min. CBT group showed a marked decrease in TIB between baseline and Week 4, dropping to 532 min at the end of treatment and dropping further to 513 min by the one month follow-up. The TIB for CBT participants was diminished by a mean of 76.2 min from baseline values to post-treatment (Week 10).

The repeated measures ANOVA did not find a significant difference between Groups (Group, $F(1, 38) = .2.01, p = .05$), but the planned orthogonal contrast identified a nearly significant difference between the CBT and the STG groups ($t(38) = -1.641, p = .057$ one-tailed). The contrast between the two treatment groups and the control group was not significant. The main effect of Time was significant, Time (Time, $F(3, 114) = 8.80, p = .001$), but the Group x Time interaction was not, $F(6, 114) = .804$, NS. Post hoc Tukey tests, showed a significant difference between CBT and WLC groups at the one month follow-up ($p = .05$). In spite of the large difference in TIB shown on Figure 1, no significant difference between CBT and STG groups was identified by post hoc multiple comparisons at any measurement point.

Total Sleep Time (TST)

As shown in Figure 1, the WLC group remained stable during the treatment at approximately 436 min sleep time, increasing to 458 min by the one month follow up. The STG group averaged 445 min sleep time throughout the study. The CBT group showed a progressive decrease from 471 min at baseline to 456 min at the end of treatment, and 441mins at the one month follow up. These decreases, impressive as they might seem, are swamped by the magnitude of the within group variability. The standard deviations for these groups ranged from 60 min to over 100 min at various measurement times.

The 3x4 repeated measures ANOVA found no significant effect for Group or Time, or their interaction (see Table 5). None of the planned orthogonal contrasts or the post-hoc multiple comparisons were significant.

Sleep Efficiency (SE)

The total sample included in this study met criteria for abnormal sleep, with SE averaging below 85% at baseline. SE values computed from patients' self-reported sleep log entries averaged 73% for the WLC and STG groups, and 81% for the CBT group at baseline. By the end of the treatment period, SE had risen by only 2 to 5% in the WLC and STG groups, but the CBT group had achieved a sleep efficiency of greater than 85%.

CBT and STG participants show an increase in SE at Week 4 which is maintained through Week 10. The SE for CBT group was increased by a mean of 6.2 %, from baseline values at post-treatment (Week 10). SE in the WLC was relatively unchanged throughout the study. This increase in SE in the CBT group approached significance in the main effect of Group in the repeated measures ANOVA, Group (Group, $F(2,38) = 2.67, p = .084$). The planned orthogonal comparison between the two treatment groups and the control group reflects this trend, with a one degree of freedom *t*-test which approaches significance, ($t(38) = 1.319, p = .10$ one-tailed). The ANOVA main effect of Time was significant, Time (Time, $F(3, 114) = 6.66, p = .001$), but the interaction of Group x Time was not (see Table 9). Post hoc pairwise comparisons determined no mean difference between WLC, STG and CBT groups, at any measurement time. However, the planned orthogonal contrast between the CBT and the STG groups showed them to be significantly different overall, ($t(38) = 1.882, p = .036$ one-tailed).

Measures of Clinical Change

Sleep Impairment Index (SII)

The summary scores for the SII administration at baseline and end of treatment, WLC: at baseline: *M* 27.31 *SD* (8.20) and post treatment 26.38 *SD* (8.30); STG: baseline: 27.00 *SD* (6.14) and post treatment 26.07 *SD* (6.16); CBT: baseline: 32.29 *SD* (6.34) and post treatment 24.57 *SD* (5.30), did not show a main effect for Group (Group, $F(2, 38) = .3974, p = .05$), but demonstrated a significant change over Time, (Time $F(2, 38) = 10.36, p = .01$). The Group x Time interaction was significant $F(2, 38) = 5.29, p = .01$, indicating a change across time. Further, post hoc comparisons revealed that the SII score for the CBT group was reduced compared to both the STG group and the WLC at Week 6, $F(2, 38), p = .02$.

Nonparametric ANOVAS based on ranked scores (Kruskal-Wallis ANOVA) were used to compare the treatment groups on questions from the SII relating to insomnia and its interference

with daily functioning. Prior to treatment onset, the three treatment groups differed significantly for response to the question, "difficulty falling asleep". Sleep onset insomnia was rated as a greater problem in the CBT and STG groups at baseline chi-squared, x^2 ($N = 41$) 9.014, 2 *df*, p =.011). At the end of the treatment period (Week 6), this measure no longer differed between the study groups. The WLC group increased its rating of "difficulty falling asleep", while the CBT group rated "difficulty falling sleep" as less of a problem by Week 6, with a mean decrease of 1.4 points, with no patient reporting an increase in "difficulty falling asleep" a Week 6. The other parts of question 1, relating to "difficulty staying asleep" or "problem with waking up too early", did not differ between groups at baseline or treatment termination.

Beliefs and Attitudes Scale (BAS)

The BAS score for CBT participants was diminished by a mean of 7.72 points from baseline, at the end of treatment (Week 6). The point reduction on the BAS at Week6 for both the WLC group and STG post-treatment score at Week 6 remained near constant with baseline. WLC: at baseline: *M* 143.46 *SD* (26.36) and post treatment *M*146.46 *SD* (28.01); STG: baseline: *M*129.00 *SD* (30.92) and post treatment *M*127.64 *SD* (32.20); CBT: baseline: *M*153.00 *SD* (38.75) and post treatment *M*108.57 *SD* (35.27),

The Group (3) x Time (2) repeated measures ANOVA for the BAS revealed no main effect for Group (Group, $F(2, 38) = 1.182$, was NS). There was, however, a significant main effect for Time (Time, $F(2, 40) = 6.41$, p =.001), as well as a significant Group x Time interaction $F(2, 38) = 4.36$, $p = .001$. The BAS score for CBT participants was diminished by a mean of 44.4 points from baseline values, at the end of treatment (Week 6). The point reduction on the BAS at Week6 for the WLC group was 19.4. The STG post-treatment score at Week 6 remained near constant with baseline. Post hoc Tukey HSD tests showed a mean difference, at Week 6, between CBT and both WLC and STG groups, $p = .001$.

Quality of Life (QoL)

The Group (3) x Time (2) repeated measures ANOVA for QoL, WLC: at baseline: *M* 48.54 *SD* (9.95) and post treatment 47.54 SD (6.74); STG: baseline: 43.07 SD (8.89) and post treatment *M* 42.93 *SD* (8.23); CBT: baseline: *M* 43.57 *SD* (10.41) and post treatment *M* 41.71 *SD* (8.43), revealed no significant main effect for Group (Group, F (2,38) = 1.94, Time (Time, F(1, 38) = .642, NS) ,and no interaction for Group x Time, F(2, 38) = 1.61, p = .05. Post hoc comparisons confirm no significance difference between groups and no change over time.

Beck Depression Inventory (BDI)

The BDI administration at baseline and end of treatment, showed, WLC: at baseline: *M* 20.38 *SD* (16.00) and post treatment *M*16.23 *SD* (10.77); STG: baseline: *M*15.64 *SD* (7.83) and post treatment *M*13.71 *SD* (7.83); CBT: baseline: *M* 22.00 *SD* (11.83) and post treatment 11.64 SD (9.83). The Group (3) x Time (2) repeated measures ANOVA for the BDI did not reveal a significant main effect for Group, (Group F(2, 38) =.443, p = .05). However, there was a significant main effect for Time(Time, F(2, 40) = 15.48, p = .001), and a significant interaction for Group x Time F(1, 38) = 3.352, p = .05. The Post hoc Tukey HSD comparison showed a significant difference between CBT and STG at Week 6 (p = .04). There was no significant difference between CBT and WLC groups. The score for CBT participants was diminished by a mean of 10.36 points from baseline values and at Week 6, while WLC was reduced by 4.15 and STG by only 1.95 points. Post hoc Tukey HSD tests showed a mean difference, at Week 6 between CBT and both WLC and STG groups, (p = .05).

Clinical Significance

Differences between study groups in their responses to the SII question "difficulty falling asleep" were evaluated at baseline and post-treatment. At baseline, patients in the CBT group reported greater difficulty in falling asleep. A nonparametric Kruskal-Wallis test found the three groups to be significantly different at baseline (p =.01). By the post-treatment evaluation, the groups were no longer significantly different. The CBT group then reported the least difficulty in

falling asleep, while the WLC group showed a marked increase in ratings of difficulty. It is possible that the initial low ratings in the WLC group underestimated their actual level of initial insomnia, due to response bias, demand characteristics, or social desirability.

Multiple regressions were conducted to determine which, if any, of the demographic variables were predictive of SE% and SL at the end of treatment (Week 6). Using baseline scores of each subject as a covariate, the demographic variables of age, gender, treatment group, diagnosis (Schizophrenic vs. Schizoaffective/Bipolar), substance abuse history, specific neuroleptic administered, and its category (typical or atypical neuroleptic), and mood stabilizer type, were used to predict end of treatment for SE and SL in separate regressions. Baseline score and group assignment were predictors for both SE and SL. SL baseline score, (p <0.001) and group assignment, (p <0.05). SE baseline score, (p <0.001) and group assignment, (p <0.05). SL was also significant for gender, (p <0.05).

Discussion

The results of the present study provide evidence that cognitive behavioral modalities, offered as a group treatment improve insomnia in a psychiatric population with diagnoses of schizophrenia, schizoaffective, and bipolar disorder. As hypothesized, participants in the CBT condition showed significant improvements on many sleep parameters, while those participants in the STG and WLC groups did not. Self-report measures of sleep onset latency, total wake time, number of awakenings, nap time, and time in bed, showed significant change with treatment. Post-treatment gains on most measures were maintained one month after the end of treatment.

Gains were not limited to subjective sleep report. The CBT group also experienced significant change in their level of psychological distress, as demonstrated by improved scores on the Beck Depression Inventory at the end of treatment. These findings suggest that participants' depressive symptoms may have responded to improvement in sleep quality.[25] While it is also possible that the improvement in mood produced the sleep changes we doubt this alternative hypothesis. Firstly, the target of the CBT treatment was sleep behaviors and beliefs and a set of measures demonstrated changes in this domain. Secondly, signs of improvement in sleep were present at early stages in treatment and the mood improvement was only measured and documented at the end of treatment.

The scores on the Quality of Life inventory did not change in any of the groups. However, subjective ratings of improved daytime fatigue, ability to function at work and daily chores, concentration, memory, mood, reduced levels of distress, as well as an increase in the level of satisfaction with current sleep patterns on the Sleep Impairment Inventory, were significantly greater for the CBT group than STG or WLC at the end of treatment. The CBT group, also showed a significant improvement in dysfunctional beliefs and attitudes about sleep.[26]

Multiple Factors Contributing to Insomnia in this Psychiatric Population

The origins of the sleep difficulties in the subjects of this study include psychiatric illness, psycho-social stress, dysfunctional cognitions and maladaptive sleep habits. Given the varied

facets of chronic insomnia in this population, the design of a comprehensive treatment protocol encompassing educational, behavioral, and cognitive components, each aimed at a specific part of the problem, appeared to be clinically warranted. There was no treatment component for the psychiatric disorders of the subjects. The subjects were in a day treatment program and receiving relatively stable doses of medications for their chronic mental illness.

This group engaged in many maladaptive sleep related habits including excessive and poorly timed caffeine ingestion and cigarette smoking, sleeping without an alarm clock, taking sedating medications too early in the evening, spending excessive amounts of time in bed, excessive napping, the employment of television, radio, and the use of music or room lighting to fall asleep or accompany sleep throughout the night. Therefore, this type of patient may be particularly well suited to benefit from interventions that target discrete behaviors.[27-29]

Dysfunctional cognitions, may have further exacerbated sleep problems.[4, 30] As a consequence of unrealistic sleep expectations and inordinate concern over the impact of sleep loss on daytime functioning, many in this sample maintained an irregular sleep schedule and spent excessive amounts of time in bed napping or resting. Although these perpetuating factors are not unique to this population, psychiatric patients may have a higher predilection to engage in these practices because of their delimited life-style, social isolation, diminished vocational opportunities, the absence of regular activities or daily routine, as well as, an already higher incidence of disturbed sleep pattern.

As the basic rest-activity cycle is synchronized by environmental cues, including social contacts, mealtimes, work schedules, and light dark cycles, , the resistance to using an alarm clock and the avoidance of time strictures, social contact, and decreased activity levels, represent serious treatment issues for this population.[4] This disempowered population also experiences a heightened resistance to surrendering control. Participants in the active treatment were profoundly intrigued by the provision regarding the importance of giving control back to the sleeper. However, self-management alien, they were resistant to stimulus control prohibitions, sleep

restriction strictures, and pre-bed rituals. Participants were extremely sedentary and frequently engaged in daytime napping which was difficult to monitor, because of participant denial. Further, it is important to acknowledge the difficulty this population experiences dealing with exceptional medication issues, cognitive limitations, hypervigilance to external stimuli, and heightened vulnerability to internal stimuli.

There were unique compliance issues related to active treatment directives. Chambers [31] asserts that compliance issues may be one of the greatest difficulties for the clinician. At the inception of this study, most participants were socially isolated and residing in living space unique to this and other severely marginalized populations. Many participants lived in SRO sites with only basic necessities. Frequently the admonition to use one's bed only for sleep or sex, required that participants find another place to sit, as their only chair often represented the place to store clothing. The suggestion to go to another room, when unable to sleep, was translated into sitting quietly away from their bed, or entering a disreputable public space outside their door. Attention and treatment time had to be focused on strategies for coping with auditory hallucinations at sleep onset and the modification of defensive coping strategies utilized by this population. These procedures inadvertently lead to compromises with sleep hygiene directives, such as listening to walkman radios while attempting to fall asleep, to screen out "voices." Many participants also reported limited ability to attend to reading material or follow the plot of a television program. Stimulus control distraction tasks included, working on puzzles, playing electronic hand held games, looking at kaleidoscopes, or other handheld low level stimuli.

Group Support Factor

The group support factor inherent in the CBT and STG groups has significant advantages, including peer modeling, and social support.[15, 32] Morin[4] asserts that the perception of control is a key element in the successful management of insomnia. Those who were most committed to their treatment, reported more control over their sleep, and the ability to cope more adaptively with residual and periodic sleep difficulties after treatment completion. Participants in active

treatment experienced increased confidence in their self-management skills, and by the end of treatment, enhanced compliance, resulting in gains being maintained for most measures at one month follow-up. Both STG and the CBT group members were able to offer fellow group members insight, further resources for problem-solving, empathic support, positive reinforcement, recognition, and validation of experience, as well as, encouragement to remain committed to participation in the study.

STG Treatment

The STG treatment was initially conceived as a placebo-control treatment that would correspond to CBT for nonspecific effects of therapist contact and interest, social interaction, and social support, considered unlikely to be effective in reducing insomnia symptoms. Therapy was unstructured, leadership non-directive, following the lead given by the participants in the group.[33,34] By the end of treatment, Week 6 and at post treatment, supportive counseling, STG occupied an intermediary position between CBT and WLC on many dependent measures. Given time, this group might have demonstrated a more positive outcome.

The open-ended nature of the STG group supportive treatment structure resulted in attempts by this group to reinvent a sleep practice without the benefit of instruction in sleep hygiene or sleep parameters. While the primary focus was on concrete, real-life issues, problems, and relationships, the group openly discussed ongoing sleep problems, offering one another suggestions and support. The extent of this focus had not been anticipated. The group leader, while encouraging and facilitating group process, refrained from offering any information about sleep, behavioral strategies, or opinions that might contaminate or undermine the focus of this group. This may have inadvertently subverted the usefulness of STG in the treatment of insomnia in this patient population. The leader avoided directly responding to subject's direct questions about sleep by turning the question over to another group member, for example, 'Mark, what do you think would be a good time for Martha to go to sleep?' This and other types of deflection may have short-circuited potentially fruitful discussions about sleep and probably produced

frustration by not addressing legitimate concerns. Kaplan and Sadock[32] assert that, for schizophrenics, groups led in a supportive manner are effective in reducing social isolation, increasing a sense of cohesiveness, and improving reality testing. The focus on specific, real-life issues in the STG group, may have offered participants a non-threatening social interaction of adequate frequency and regularity.[33] Therefore, we consider the STG group a complicated intervention that contains elements of a placebo, active sleep intervention, psycho-social support and possibly a frustrating experience.

WLC Group

The WLC group did not receive any treatment for 10 weeks while they monitored their sleep. Interaction with the primary investigator on a nearly daily basis for data collection may have heightened awareness of sleep problems. Behaviors that produce good sleep may have been promoted by insight gained by the nearly daily oral report of sleep log data and consistent positive contact with the primary investigator,[33, 35] resulting in an improved outcome in this group. Similarly, others may have endorsed a good night of sleep, as a consequence of believing that they should be getting better because of the frequent contact with the primary investigator. As a result of either of these scenarios there would be reduced significance for the CBT treatment. Other subjects may have, consciously or unconsciously, provided data that showed how poorly they slept to justify future treatment. If this occurred it would have enhanced the appearance of the CBT treatment by comparison.

As a result of the absence of polysomnographic data, it is conceivable that those with occult sleep disorders, such as, sleep apnea and periodic limb movements were included in the sample. This would suggest that the treatment response attained with the present sample might be a conservative estimate of the effect that could be obtained with a sample that excluded such physiological sleep disorders.

Morin[4] reports that it is difficult to collect sleep log data from psychotic patients. The cognitive limitations of many participants necessitated increased one to one contact with all

participants for weekday oral collection of sleep log data. All pre/post data was orally administered by the principle investigator and research assistants. The primary investigator collected data for a total of nine subjects, across the two post-assessment time periods. Care was taken to obscure the treatment group identity from co-investigators during the post treatment assessment period. Data collected, provided the opportunity to compute the length of TST by looking at "lights out" time, minus estimated SL, to rise time. Subject's reluctance and/or inability to estimate length of time awake during each arousal across the night resulted in the need to look at subject generated estimates of TST with skepticism. Respondents would often answer the question, "How long did you sleep?" with a response that lead the investigator to conclude that, while the participant had spent 360mins time in bed, reported sleep time had totaled over 420mins. However, in keeping with other parameters, it was determined that outcome data should reflect subjective responses, rather than an investigator generated, mathematical total. Where participants report TST totals over 100%, data reflect a ceiling cutoff of 100% and a baseline cutoff of 0%. This statistic does not allow for documentation of extended nighttime awakenings and may have compromised significance on total wake time and SE % data outcome.

Throughout this study, all patients remained on the prescribed medication they had used at baseline assessment. Every effort was made to keep medication unchanged and medication levels for all participants stable. However, two of the participants in the STG condition had their medication level adjusted, (1 increased, 1 decreased).

The results achieved in this study support earlier work [5] suggesting that non-pharmacological group treatment can be an effective method for the management of sleep disturbance in those with a chronic psychiatric disorder. While group treatment for insomnia may not be indicated or sufficient for all individuals with coexistent psychiatric disorder,[4] this treatment format offers several specific advantages for this chronically mentally ill population, including low-cost, peer support, and accessibility. Future research should explore who is most likely to benefit from a

group treatment model, as well as, the predictors for treatment success with this population and treatment model.

Table 1. Demographics

	Treatment Group			
	Waitlist Control WLC, n=13	Stress Treatment Group STG, n=14	Cognitive-Behavioral Group CBT, n=14	Total n=41
Age (years) M(SD)	37.9 (9.4)	39.9 (10.8)	37.1 (9.7)	37.4(10.1)
Gender				
M	6	9	8	23
F	7	5	6	18
Diagnosis				
Schizophrenia	5	5	5	15
Schizoaffective	8	8	8	24
Bipolar	0	1	1	2
Neuroleptic				
Typical	5	7	7	19
Atypical	8	7	7	22
Mood Stabilizer				
Depacote	3	1	3	7
Lithium	1	2	1	4
Lith/Tegretol	0	0	1	1
None	9	11	9	29
Substance Abuse				
Positive	5	8	5	18
Negative	8	6	9	23

Table 2. Neuroleptic Use by Treatment Group

	Treatment Group			
	Waitlist Control WLC (n=13)	Stress Group Control STG (n=14)	CBT Group CBT (n=14)	Total (n=41)
Neuroleptic Group				
Typical Neuroleptic				
Haloperidol/Haldol	1	2	4	7
Fluphenazine/Prolixin	2	1	0	3
Chlorpromazine/Thorazine	0	1	1	2
Thiothixine/Navane	0	1	1	2
Molindone/Moban	0	0	1	1
Perphenazine/Trilafon	1	1	0	2
Thioridazine/Mellaril	0	1	0	1
Subtotal	4	7	7	18
Atypical Neuroleptic				
Resperdol/Resperidol	2	1	2	5
Olanzapine/Zyprexa	7	5	5	17
Clozapine/Clozaril	0	1	0	1
Subtotal	9	7	7	23
Overall Total	13	14	14	41
Mood Stabilizer				
Sodium divalproex/Depakote	3	1	3	7
Chlordiazepoxide/Lithium	1	2	1	4
Carbamazipine/Tegretol	0	0	1	11
Total	4	3	5	12

Table 3. Outline of (CBT) Insomnia Treatment Protocol

Screening and Assessment

1-2 Individual Meetings

- **Semi-structured interview, administration of SCL-90-R Symptom Checklist, Beck Inventory, Quality of Life Instrument, Beliefs and Attitudes about Sleep Scale, Sleep Impairment Index previous to matching and following the end of active treatments at Week 6.**
- **Baseline sleep diary instruction and monitoring**
- **Collection of sleep log data on a daily basis for baseline week, Week 4, Week 6, Week 10.**

Treatment

Treatment Session 1

- **Group members introduce themselves and delineate their sleep problems.**
- **Sleep diaries reviewed.**
- **Explanation of self-monitoring/self-management approach.**
- **Identification of goals for each participant.**
- **Treatment overview and social learning explanation of insomnia.**
- **Behavioral component: Introduction of stimulus control instruction and sleep restriction therapy, e.g., the necessity of using an alarm clock to regulate wake time, directive to avoid napping.**

Treatment Session 2

- **Sleep diaries are reviewed and self-monitoring/self-management approach is reinforced.**
- **Resistance and obstacles to implementing these procedures discussed.**
- **Educational component: basic facts about the nature of sleep, arousal and changes experienced across the lifespan.**

Treatment Session 3

- **Sleep diaries are reviewed and self-monitoring/self-management approach is reinforced.**
- **Problem-solving difficulties.**
- **Discussion of methods to enhance compliance.**
- **Sleep hygiene component: caffeine, nicotine, alcohol, exercise, diet, noise, light, temperature.**

Treatment Session 4

- **Sleep diaries are reviewed and self-monitoring/self-management approach is reinforced**
- **Cognitive restructuring: basic goals, rationale and relationship to insomnia, discussion of beliefs and attitudes, and adaptive substitutes.**
- **Instruction to monitor sleep-related self-statements for following week.**

Treatment Session 5

- **Sleep diaries are reviewed and self-monitoring/self-management approach is reinforced.**
- **Review and integration of all therapy components.**
- **Review of methods for promoting adherence.**
- **Programming generalization of newly learned skills.**

Treatment Session 6

- **Sleep diaries are reviewed and self-monitoring/self-management approach is reinforced.**
- **Identification of high-risk situations.**
- **Review of relapse prevention strategies.**
- **Review of progress to date and achievement of goals.**
- **Strategies offered for further consolidation of therapeutic gains.**

After Lacks, 1991; Morin, 1993

Table 4. Outline of (STG) Supportive Psychotherapy Treatment Protocol

Screening and Assessment

1-2 Individual Meetings

- Semi-structured interview, administration of SCL-90-R Symptom Checklist, Beck Inventory, Quality of Life Instrument, Beliefs and Attitudes about Sleep Scale, Sleep Impairment Index previous to matching and following the end of active treatments at Week 6.
- Baseline sleep diary instruction and monitoring
- Collection of sleep log data on a daily basis for baseline week, Week 4, Week 6, Week 10.

Treatment

- Frequency and duration of treatment is once a week for six weeks.
- Therapy is unstructured and follows the lead given by the group participants. While members rely upon the leader, interdependency between members is encouraged; socialization outside the group is encouraged
- Focus is on ability to cope; stabilization, or restoration of pre-existing equilibrium; strengthening of defenses; better adjustment or acceptance of pathology; symptom relief and environmental restructuring as primary goals.
- Support reality testing, provide ego support
- Maintain or reestablish usual level of functioning
- Therapist is predictably available
- Interpretation used to strengthen defenses and maintain working, reality-based relationship based upon support, concern, and problem-solving

After Kaplan and Sadock, 1991;Yalom, 1970.

Table 5. Outline of Waitlist Control (WLC) Protocol

Screening and Assessment
1-2 Individual Meetings
• **Semi-structured interview, administration of SCL-90-R Symptom Checklist, Beck Inventory, Quality of Life Instrument, Beliefs and Attitudes about Sleep Scale, Sleep Impairment Index previous to matching and following the end of active treatments at Week 6.**
• **Baseline sleep diary instruction and monitoring**
• **Collection of sleep log data on a daily basis for baseline week, Week 4, Week 6, Week 10.**
Treatment
• **No treatment is offered. All participants remain on a wait list for treatment.**

Table 6. Reported Sleep Parameters for Wake States from Daily Sleep Logs

Time Condition	Baseline Mean SD	Week4 Mean SD	Week6 Mean SD	Week10 Mean SD
Sleep Latency				
WLC	44.24 (29.11)	41.84 (31.53)	45.95 (33.30)	42.48 (28.95)
STG	61.80 (33.39)	61.52 (36.72)	67.13 (39.40)	64.45 (57.95)
CBT	66.93 (42.79)	42.08 (24.33)	35.65 (19.24)**	36.78 (23.04)
WLC vs STG	-	-	-	-
WLC vs CBT	-	-	-	-
STG vs CBT	-	-	♦	-
Total Wake Time				
WLC	102.18 (46.04)	95.77 (52.46)	82.78 (50.51)*	78.63 (47.15)
STG	138.63 (76.71)	142.61 (86.01	138.43 (69.74)	135.77 (103.05)
CBT	112.73 (43.11)	63.00 (31.89)**	59.12 (29.76)***	56.23 (30.43)**
WLC vs STG;	-	-	♦	-
WLC vs CBT;	-	-	-	-
STG vs CBT	-	♦♦	♦♦♦	♦♦
Number of Awakenings				
WLC	1.83 (.87)	1.79 (.78)	1.72 (.89)**	1.68 (.86)
STG	1.91 (.82)	2.00 (1.07)	1.88 (1.00)	1.62 (.88)
CBT	1.26 (.58)	.84 (.62)**	.92 (.56)**	.88 (.50)*
WLC vs STG;	-	-	-	-
WLC vs CBT;	-	♦	♦	♦
STG vs CBT	-	♦♦	♦	♦

WLC = Wait List Control; STG = Stress Treatment Group; CBT = Cognitive Behavioral Treatment. Time difference (within groups), as compared to baseline, is signified by *$p < .05$; ** $p < .01$; ***$p < .001$. Differences between groups is signified by ♦$p < .05$; ♦♦ $p < .01$; ♦♦♦$p < .001$. Numbers represent means in minutes and standard deviation.

Table 7. Reported Sleep Parameters for Sleep States from Daily Sleep Logs

Time	Baseline		Week4		Week6		Week10	
Condition	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Time in Bed								
WL	610.57	(83.66)	600.57	(85.94)	588.01	(65.10)	583.79	(61.71)
STG	613.39	(101.68)	592.65	(99.18)	582.11	(97.77)	572.52	(83.80)
CBT	588.94	(97.17)	545.39	(78.45)	531.56	(57.58)	512.73	(62.73)*
WLC vs STG	-		-		-		-	
WLC vs CBT	-		-		-		◆	
STG vs CBT	-		-		-		-	
Total Sleep Time								
WLC	438.36	(88.06)	437.64	(73.52)	435.56	(85.26)	457.58	(80.35)
STG	439.17	(94.59)	454.39	(106.61)	446.78	(95.64)	442.07	(89.84)
CBT	470.94	(95.85)	463.88	(70.59)	455.87	(69.57)	441.05	(60.33)
Nap Time								
WLC	48.98	(43.89)	41.87	(36.40)	56.76	(65.78)	37.86	(30.00)
STG	26.83	(33.11)	18.57	(33.78)	13.37	(31.18)*	15.15	(38.34)
CBT	45.82	(54.44)	14.90	(18.28)	6.58	(8.97)**	12.55	(18.30)
WLC vs STG	-		-		◆		-	
WLC vs CBT	-		-		◆◆		-	
STG vs CBT	-		-		-		-	
Sleep Efficiency %								
WLC	73.04	(16.07)	75.01	(14.72)	74.86	(15.00)	79.03	(13.56)
STG	73.15	(11.88)	77.51	(12.65)	77.75	(13.86)	77.96	(11.14)
CBT	80.93	(10.63)	86.22	(11.38)	85.97	(9.37)	86.41	(8.35)

WLC = Wait List Control; STG = Stress Treatment Group; CBT = Cognitive Behavioral Treatment. Time difference (within groups), as compared to baseline, is signified by *$p < .05$; ** $p < .01$; ***$p < .001$. Differences between groups is signified by ◆$p < .05$; ◆◆ $p < .01$; ◆◆◆$p < .001$. Numbers Represent Means in Minutes and Standard Deviation, Sleep Efficiency % Represents TST/TIB x 100

Appendix Table 1. Measures of Clinical Change: Means and Standard Deviation

	Pretreatment Mean SD	Post treatment Mean SD
Sleep Impairment Index (SII)		
WLC	27.31 (8.20)	26.38 (8.30)
STG	27.00 (6.14)	26.07 (6.16)
CBT	32.29 (6.34)	24.57 (5.30)**
WLC vs STG	-	-
WLC vs CBT	-	◆
STG vs CBT	-	◆
Beliefs and Attitudes Scale (BAS)		
WLC	143.46 (26.36)	146.46 (28.01)
SGC	129.00 (30.92)	127.64 (32.20)
CBT	153.00 (38.75)	108.57 (35.27)**
WLC vs STG	-	-
WLC vs CBT	-	◆◆◆
STG vs CBT	-	◆◆◆
Quality of Life (QofL)		
WLC	48.54 (9.95)	47.54 (6.74)
STG	43.07 (8.89)	42.93 (8.23)
CBT	43.57 (10.41)	41.71 (8.43)
Beck Depression Inventory (BDI)		
WLC	20.38 (16.00)	16.23 (10.77)
STG	15.64 (8.40)	13.71 (7.83)
CBT	22.00 (11.83)	11.64 (9.83)***
WLC vs STG	-	-
WLC vs CBT	-	-
STG vs CBT	-	◆

WLC = Wait List Control; STG = Stress Treatment Group; CBT = Cognitive Behavioral Treatment. Time difference (within groups), as compared to baseline, is signified by *$p < .05$; ** $p < .01$; ***$p < .001$. Differences between groups is signified by ◆$p < .05$; ◆◆ $p < .01$; ◆◆◆$p < .001$.

Appendix Table 2. Subjects Withdrawn from the Study

Group	Diagnosis	Age/Gender	Drug	M/ST	SU/A	Reason
CBT	SA	26 F	Resperidol	Valproic acid	Neg	Nonparticipation/pregnant
CBT	SA	26 M	Olanzapine	none	Neg	Refusal to report sleep
STG	SA	31 M	Olanzapine	none	Neg	Refusal to report sleep
STG	BP	29 M	Stelazine	none	Neg	Re-hospitalization
WLC	SA	51 M	Haldoperidol	Valproic acid	Neg	Refusal to report sleep
WLC	SA	39 M	Olanzapine	none	Neg	Refusal to report sleep
WLC	SA	21 F	Haldoperidol	Valproic acid	Neg	Left program/ country

WLC = Wait List Control; STG = Stress Treatment Group; CBT = Cognitive Behavioral Treatment. S = Schizophrenic; SA = Schizoaffective; BP = Bipolar; M/ST = Mood Stabilizer; SU/A = Substance Abuse.

Appendix Table 3. ANOVA Summary Tables for Reported Wake State Parameters from Daily Sleep Logs: Effect Size and Power

Source	*df*	*MS*	*df*	*MSE*	*F* Value	*p*-level	ES	Power
Sleep Latency								
Group	2	6836.14	38	3806.00	1.796	0.180♦	.086	.352
Time	2.04	1249.38	77.49	515.23	2.425	.094♦	.060	.592
GroupXTime	4.08	1129.75	77.49	515.23	3.225	.006*♦	.145	.916
Total Wake Time								
Group	2	65687.63	38	11604.50	5.661	.007 **♦	.230	.833
Time	2.78	6718.32	105.8	1048.34	6.409	.001 ***♦	.144	.964
GroupXTime	5.57	2930.99	105.8	..1048.34	2.796	.017 **♦	.128	.866
Number of Awakenings								
Group	2	12.92	38	2.25	5.754	.007**♦	.232	.839
Time	2.89	0.53	109.7	0.12	4.572	.005**♦	.107	.878
GroupXTime	5.77	0.22	109.7	0.12	1.877	.094♦	.090	.677

Adjusted Huynh-Feldt Epsilon *p*-value given♦; *$p < .05$; ** $p < .01$; ***$p < .001$. N Required for Power = .80 for Group Effect.

Appendix Table 4. ANOVA Summary Tables: Sleep Parameters from Daily Sleep Logs Effect Size and Power

Source	*df*	*MS*	*df*	*MSE*	*F* Value	*p*-level	ES	Power
Time in Bed								
Group	2	4325.31	38	21547.34	2.007	.148♦	.096	.389
Time	2.80	1739.59	106.2	2120.31	8.801	.000***♦	.188	.994
GroupXTime	5.59	1589.32	106.2	2120.31	.804	.561♦	.041	.308
Total Sleep Time								
Group	2	3726.78	38	24663.32	0.151	.860	.008	.072
Time	3	316.46	105.37	1591.97	.199	.884♦	.005	.086
GroupXTime	6	2144.45	105.37	1591.97	1.347	1.54♦.	.066	.509
Nap Time								
Group	2	1311.07	38	4017.04	3.265	.049*♦	.147	.586
Time	2.81	2854.40	106.6	545.82	5.593	.002**♦	.128	.937
GroupXTime	5.61	1389.25	106.6	545.82	2.722	.019*♦	.125	.856
Sleep Efficiency %								
Group	2	1493.04	38	543.146	2.639	.084♦	.122	.493
Time	2.95	271.73	111.9	40.83	6.656	.000***♦	.149	.970
GroupXTime	5.89	23.228	111.9	40.823	.0.569	.751♦	.029	.220

Adjusted Huynh-Feldt Epsilon *p*-value given♦; *$p < .05$; ** $p < .01$; ***$p < .001$. N Required for Power = .80 for Group Effect.

Appendix Table 5. Maunchley's Test of Sphericity for Primary Variables

Within-subjects Effect	Maunchley's *W*	*df*	Significance
Sleep Latency	.376	5	.000***
Number of Awakenings	.783	5	.109**
Total Wake Time	.616	5	.003**
Time In Bed	.651	5	.008**
Naptime	.703	5	.024*
Total Sleep Time (objective)	.701	5	.023*
Total Sleep Time (subjective)	.753	5	.064
Sleep Efficiency (objective)	.503	5	.000***
Sleep Efficiency (subjective)	.754	5	.053*

*$p < .05$; ** $p < .01$; ***$p < .001$.

Appendix Table 6. Performance Difference Between Both Treatment Groups Combined and Wait List Control: Summary of One Degree of Freedom Orthogonal Contrasts Between Groups

Variable	ANOVA *p* for Group (2 *df*)	Contrast *t* (1 *df*)	*p* 1-tailed (38 *df*)	Welch's *p* 1-tailed
Sleep Efficiency %(objective)	NS	-0.59316	NS	NS
Sleep Efficiency %(subjective)	.084	1.3188	.0976	.1019
Total Sleep Time (subjective)	NS	0.35988	NS	NS
Total Sleep Time (objective)	NS	-1.7982	.0400*	.0415*
Time In Bed	NS	-1.1499	.1287	.1308
Total Wake Time	.007**	0.8838	NS	NS
Sleep Latency	NS	1.0544	NS	NS
Number of Awakenings	.007**	-1.3599	.0909	.0949
Naptime	.049*	-2.5522	.0074**	.0107*

Adjusted Huynh-Feldt Epsilon p-value given ♦; *$p < .05$; ** $p < .01$; ***$p < .001$.

Appendix Table 7. Performance Differences Between CBT (Active Treatment Group) and Stress Treatment Group Degree of Freedom Orthogonal Contrasts Between Groups

Variable	ANOVA *p* for Group (2 *df*)	Contrast *t* (1 *df*)	*p* 1-tailed (38 *df*)	Welch's *p* 1-tailed
SleepEfficiency %(objective)	NS	1.8147	.0387*	.0442*
Sleep Efficiency %(subjective)	.084	1.8815	.0338*	.0363*
Total Sleep Time (objective)	NS	0.7446	.0400*	NS
Total Sleep Time (subjective)	NS	0.4156	NS	NS
Time In Bed	NS	-1.6407	NS	.0572
Total Wake Time	.007**	-3.2465	.0546	.0025**
Sleep Latency	NS	1.5749	.0012**	.0648
Number of Awakenings	.007**	-3.1071	.0618	.0028**
Naptime	.049*	0.1236	NS	NS

Adjusted Huynh-Feldt Epsilon p-value given; *$p < .05$; ** $p < .01$; ***$p < .001$.

Appendix Table 8. Summary of One Degree of Freedom Orthogonal Contrasts Within Subjects: Linear, Quadratic, Cubic, Means Square, F and p Level for Reported Wake State Parameters from Daily Sleep Logs

Source	*df*	*MS*	*F* Value	*p*-level
Sleep Latency				
Time	2.039	1249.376	2.425	.094◆
Linear	1	1623.441	2.285	.139
Quadratic	1	576.422	2.692	.109
Cubic	1	347.855	2.758	.105
Total Wake Time				
Time	2.78	6718.317	6.409	.001***◆
Linear	1	16556.653	11714	.001***
Quadratic	1	2051.461	1.943	.171
Cubic	1	89.715	0.200	.657
Number of Awakenings				
Time	2.877	0.531	4.572	.005**◆
Linear	1	1.482	20.452	.000***
Quadratic	1	0.0015	0.012	.915
Cubic	1	0.048	0.357	.554

Adjusted Huynh-Feldt Epsilon p-value given◆; *$p < .05$; ** $p < .01$; ***$p < .001$.

Appendix Table 9. Summary of One Degree of Freedom Orthogonal Contrasts Within Subjects: Linear, Quadratic, Cubic, Means Square, F and p Level for Reported Sleep Parameters from Daily Sleep Logs

Source	df	*MS*	*F* Value	*p*-level
Time In Bed				
Time	2.80	18659.974	8.801	.000***◆
Linear	1	49940.845	18.210	.000***
Quadratic	1	1974.504	1.155	.289
Cubic	1	249.010	0.169	.684
Total Sleep Time				
Time	3	3123.148	1.556	.038*◆
Linear	1	8925.877	3.810	.058
Quadratic	1	74.026	3.955	.054*
Cubic	1	8.749	0.514	.478
Nap Time				
Time	2.81	3052.624	5.593	.002**◆
Linear	1	6333.838	10.468	.003**
Quadratic	1	1405.652	3.105	.086
Cubic	1	824.043	1.741	.195
Sleep Efficiency %				
Time	2.95	271.730	6.656	.000***◆
Linear	1	695.655	12.950	.001***
Quadratic	1	54.678	1.952	.255
Cubic	1	50.050	1.952	.170

Adjusted Huynh-Feldt Epsilon p-value given◆; *$p < .05$; ** $p < .01$; ***$p < .001$.

Appendix Table 10. Measures of Clinical Change, *F* and *p* Level and Effect Size

Source	*df*	*MS*	*df*	*MSE*	*F* Value	*p*-level	ES	Power
Sleep Impairment Index (SII)								
Group	2	28.6714	38	72.15016	.39738	.6748	.020	.109
Time	1	208.1786	38	20.08827	10.36319	.0026**	.214	.880
GroupXTime	2	106.2130	38	20.08827	5.28732	.0094**	.218	.805
Beliefs and Attitudes Scale (BAS)								
Group	2	1915.136	38	1620.925	1.181508	.3178	.059	.243
Time	1	4516.201	38	467.039	9.669861	.0035**	.203	.086
GroupXTime	2	4538.153	38	467.039	9.716864	.0004***	.338	.974
Quality of Life (QoL)								
Group	2	242.5305	38	125.2603	1.936213	.1582	.092	.376
Time	1	20.4750	38	31.9135	.641577	.4281	.017	.122
GroupXTime	2	1129.748	38	31.9135	.161150	.8517	.008	.073
Beck Depression Inventory (BDI)								
Group	2	90.2212	38	203.8882	.44250	.6457	.023	.117
Time	1	614.8395	38	39.7084	15.48388	.0003***	.29	.970
GroupXTime	2	1129.748	38	39.7084	3.35199	.0456*	.15	.598

Adjusted Huynh-Feldt Epsilon *p*-value given; *$p < .05$; ** $p < .01$; ***$p < .001$. N Required for Power = .80 for Group Effect.

Appendix Table 11. Reported Sleep Parameters: Total Sleep Time and Sleep Efficiency from Daily Sleep Logs. Numbers Represent Means in Minutes and Standard Deviation, Sleep Efficiency % Represents TST/TIB x 100

Total Sleep Time				
WLC	438.36 (88.06)	437.64 (73.52)	435.56 (85.26)	457.58 (80.35)
STG	439.16 (94.59)	454.39 (106.61)	446.78 (95.64)	442.07 (89.84)
CBT	470.94 (95.85)	463.88 (70.59)	455.87 (69.57)	441.05 (60.33)
Total Sleep Time (Objective)				
WLC	508.39 (55.93)	504.12 (84.38)	505.23 (60.68)	505.16 (58.14)
STG	474.76 (108.77)	450.04 (106.76)	443.67 (97.95)	436.76 (107.17)
CBT	476.21 (85.87)	482.41 (76.41)	472.44 (57.80)	456.50 (50.44)
Sleep Efficiency %				
WLC	73.04 (16.07)	75.01 (14.72)	74.86 (15.00)	79.03 (13.56)
STG	73.15 (12.64)	77.51 (12.64)	77.75 (13.90)	77.96 (14.48)
CBT	80.93 (10.63)	86.22 (11.38)	85.97 (9.37)	86.41 (8.35)
Sleep Efficiency % (Objective)				
WLC	83.67 (5.72)	85.82 (8.12)	86.17 (7.63)	86.81 (6.87)
STG	80.54 (11.51)	79.20 (12.86)	79.24 (11.14)	79.10 (15.42)
CBT	81.21 (7.34)	88.45 (5.09)	88.88 (5.41)	89.26 (5.33)

WLC = Wait List Control; SGC = Stress Treatment Group; CBT = Cognitive Behavioral Treatment. Time difference (within groups), as compared to baseline, is signified by $*p < .05$; $** p < .01$; $***p < .001$. Objective = Investigator calculated data based upon subjective data.

Appendix Table 12. Means Square, Mean Square Error, *F* and *p* Level and Effect Size for Reported Sleep Parameters from Daily Sleep Logs

Source	*df*	*MS*	*df*	*MSE*	*F* Value	*p*-level	*ES*
Total Sleep Time							
Group	2	3726.78	38	24663.32	0.151	.860	.008
Time	3	316.46	105.37	1591.97	.199	.884♦	.225
GroupXTime	6	2144.45	105.37	1591.97	1.347	1.54♦	.066
Total Sleep Time (Objective)							
Group	2	4051.65	38	21387.77	1.894	.164	.091
Time	2.88	2992.90	109.25	1923.26	1.556	.206	.039
GroupXTime	5.75	1232.86	109.25	1923.26	.641026	.690	.033
Sleep Efficiency %							
Group	2	1493.04	38	543.1455	2.639	.084	.123
Time	2.95	271.73	111.9	40.828	6.656	.000***♦	.132
GroupXTime	5.89	23.228	111.9	40.828	.0.569	.751♦	.224
Sleep Efficiency %(0bjective)							
Group	2	629.471	38	345.449	1.822	.176	.150
Time	2.47	101.520	93.83	32.320	3.141	.038*♦	.086
GroupXTime	4.94	72.1585	93.83	32.320	3.011	.015*♦	.129

Adjusted Huynh-Feldt Epsilon *p*-value given♦; *$p < .05$; ** $p < .01$; ***$p < .001$.

Appendix Table 13. Summary of One Degree of Freedom Orthogonal Contrasts Within Subjects: Linear, Quadratic, Cubic, Means Square, *F* and *p* Level for Reported Sleep Parameters from Daily Sleep Logs

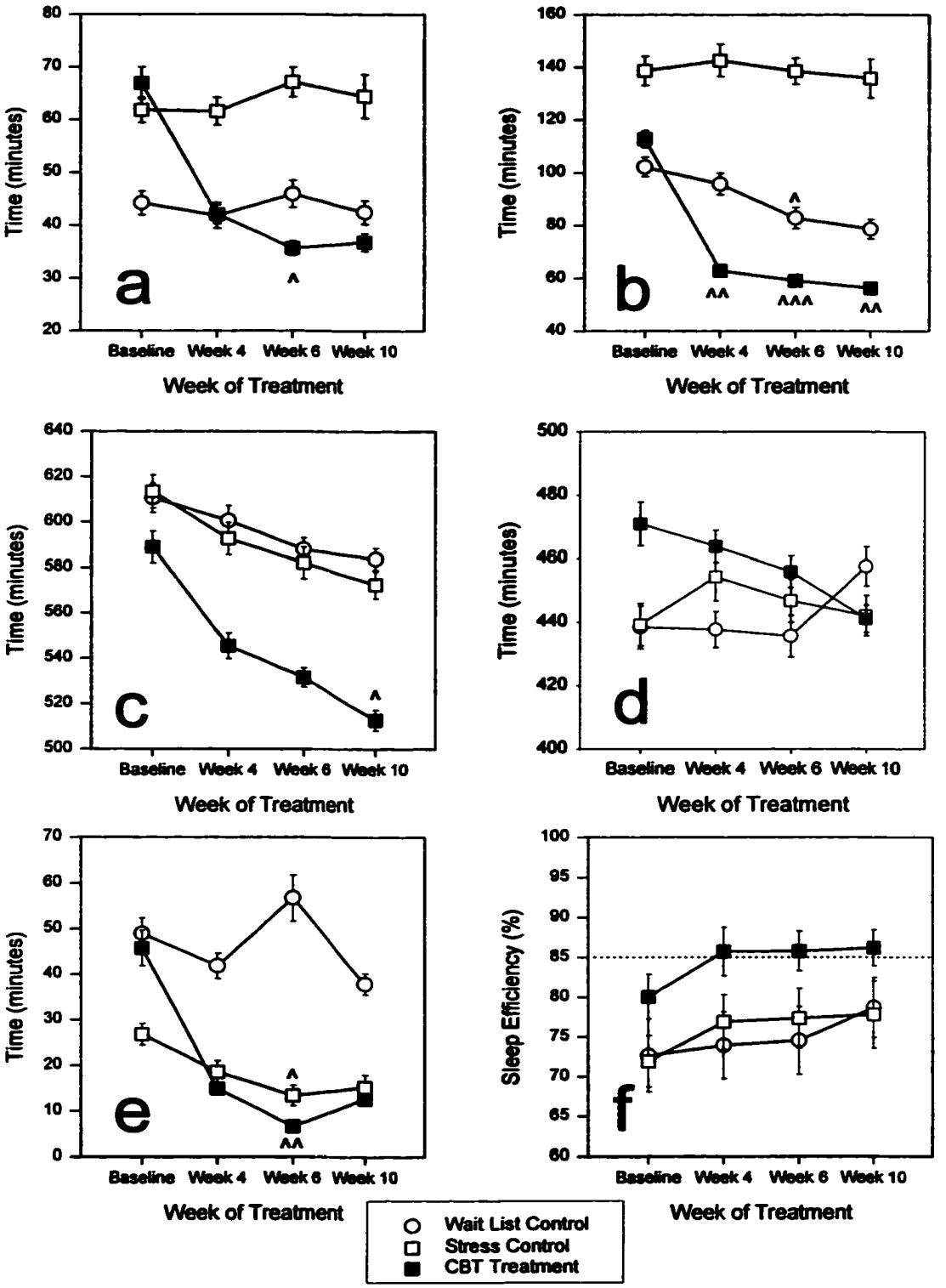
Source	*df*	*MS*	*F* Value	*p*-level
Total Sleep Time				
Time	3	3123.148	1.556	.038*♦
Linear	1	8925.877	3.810	.058
Quadratic	1	74.026	3.955	.054
Cubic	1	8.749	0.514	.478
Total Sleep Time (Objective)				
Time	3	316.463	0.199	.884♦
Linear	1	382.296	0.183	.671
Quadratic	1	27.666	0.022	.883
Cubic	1	467.543	0.433	.515
Sleep Efficiency %				
Time	2.95 2	271.730	6.656	.000***♦
Linear	1	695.655	12.950	.001
Quadratic	1	54.678	1.952	.255
Cubic	1	50.05	1.952	.170
Sleep Efficiency %(Objective)				
Time	2.80	101.520	8.801	.038*♦
Linear	1	167.887	3.810	.058
Quadratic	1	74.026	3.955	.054
Cubic	1	8.749	0.514	.478

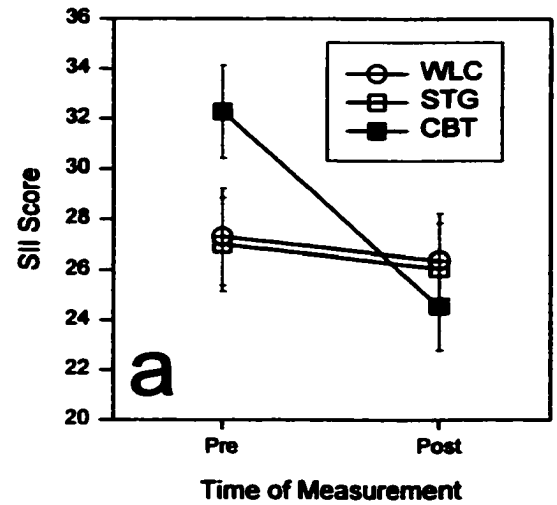
Adjusted Huynh-Feldt Epsilon p-value given ♦; *$p < .05$; **$p < .01$; ***$p < .001$.

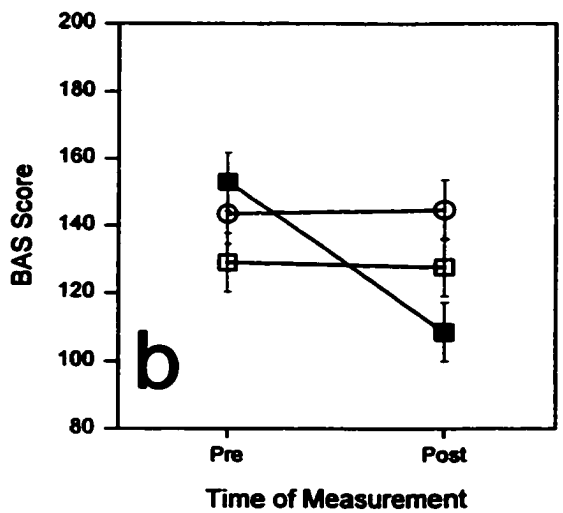
Figure 1. Reported Sleep Parameters for Wake States from Daily Sleep Logs

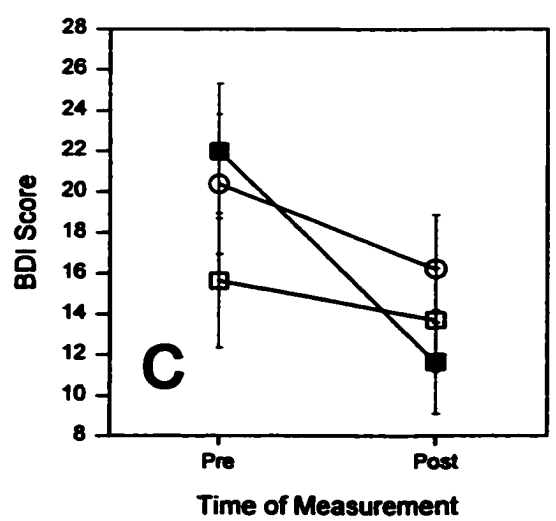
***a* Treatment effects on sleep latency (SL) means; b. treatment effects on total wake time (TWT) means; c. treatment effects on time in bed (TIB); d. treatment effects on total sleep time (TST) means; e. treatment effects on Nap Time (NT) means; f. treatment effects on sleep efficiency percentage (SE%) means among WLC = Wait List Control; STG = Stress Treatment Group; CBT = Cognitive Behavioral Treatment at Baseline, Week 4, Week 6, and Week 10.**

Figure 2.a. **Treatment effects on Sleep Impairment Index (SII) means; b. treatment effects on Beliefs and Attitudes Scale (BAS) means; c. treatment effects on Beck Depression Inventory (BDI) means among WLC = Wait List Control; STG = Stress Treatment Group; CBT = Cognitive Behavioral Treatment at Pre-treatment and Post treatment.**









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