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A Multi-Study Investigation of Patient Engagement in Psychological Treatment

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A multi-study investigation of patient engagement in psychological treatment

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Abstract

A multi-study investigation of patient engagement in psychological treatment

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Patient treatment engagement is a construct composed of two parts: attitudinal engagement and behavioral engagement. Although previous studies have started to demonstrate a relation between treatment engagement and treatment outcome, such research typically has limited long-term follow-up, often focuses on only one treatment or patient population, utilizes varied measures of engagement, and often measures attitudinal *or* behavioral engagement (but not both). The present study seeks to address these gaps by evaluating treatment engagement across three different interventions and three different patient populations: adults with interepisode bipolar disorder and insomnia (N = 58), adults with depression (N = 48), and adolescents with sleep and circadian problems (N = 176). The first aim was to examine whether attitudinal engagement with treatment—measured as higher credibility/expectancy scores—predicts treatment outcome. The second was to examine whether behavioral engagement with treatment—measured as ratings of adherence by providers—predicts treatment outcome. Results from Study 1 and Study 3 indicate that attitudinal engagement is associated with select measures of treatment outcome. Results from Study 2 suggest that attitudinal engagement is associated with an improvement in symptoms whereas behavioral engagement is associated with improvement in functioning. Overall, results underscore the impact of attitudinal engagement on treatment outcome and highlight important areas for future research.

Dedication

To my advisor, Allison Harvey, for teaching me to be a scientist and for your mentorship, support, and guidance.

To my mom and in loving memory of my dad for modeling hard work and for always encouraging me to do my best.

To Matthew for always believing in me.

To my lab twin, Caitlin: I would not have made it through graduate school without you.

To Sam for your unwavering support.

To Michelle for being my best friend, for being my biggest and best cheerleader, for the endless encouragement, and for never doubting I would file this dissertation.

A multi-study investigation of patient engagement in psychological treatment

Mental health disorders are highly prevalent worldwide (Scott, de Jonge, Stein, & Kessler, 2017; Whiteford et al., 2013). Promisingly, evidence-based psychological treatments have been developed and shown to be effective for a variety of mental health disorders (Clark, 2018; Layard & Clark, 2014). Despite these advances in treatment development, patients are often not engaged. For example, approximately one-fifth of adults who begin treatment terminate prematurely (Swift, Greenberg, Tompkins, & Parkin, 2017). The figures are even worse for youth: approximately half of children and adolescents who begin treatment drop out (de Haan, Boon, de Jong, Hoeve, & Vermeiren, 2013; Harpaz-Rotem, Leslie, & Rosenheck, 2004; Nock & Ferriter, 2005) and only half of families who seek treatment actually attend a first session (Pellerin, Costa, Weems, & Dalton, 2010). Clearly, patient treatment engagement is a significant problem.

Staudt (2007) has conceptualized patient treatment engagement as a construct comprising two parts: attitudinal engagement and behavioral engagement. Attitudinal engagement captures a patient's emotional investment and commitment to therapy, such as attitudes, beliefs, and expectations about treatment. Colloquially, attitudinal engagement is patient "buy in" (Yatchmenoff, 2005). On the other hand, behavioral engagement focuses on behavioral indicators of involvement in treatment, such as attending treatment sessions, arriving to sessions on-time, completing homework, and adhering to treatment recommendations. In line with key studies (Hock et al., 2015; Kim, Munson, & McKay, 2012; King, Currie, & Petersen, 2014; Lindsey et al., 2019), this investigation employs Staudt's (2007) conceptualization and includes one measure from each of these approaches.

Separating attitudinal engagement from behavioral engagement is important, as different barriers, and therefore solutions, exist for each. Barriers to attitudinal engagement include lack of motivation, unclear expectations, poor experiences in prior treatment, and stigma (Becker et al., 2015; King et al., 2014). Meanwhile, barriers to behavioral engagement can often be practical, such as a lack of transportation, lack of childcare, or scheduling difficulties (Harvey & Gumport, 2015; Kreyenbuhl, Nossel, & Dixon, 2009; Yu et al., 2019).

Treatment Engagement and Treatment Outcome

Prior research has identified a relation between attitudinal engagement at baseline with outcomes at post-treatment. Results from a meta-analysis demonstrated that attitudes toward treatment were associated with outcomes, with small to medium effect sizes (Sheeran et al., 2016). Similarly, beliefs about treatment efficacy at baseline, such as increased hopelessness and greater pessimism about symptom change, were associated with worse treatment response following treatment completion and with increased risk of dropout for adults receiving treatment for depression and substance use (Dearing, Barrick, Dermen, & Walitzer, 2005; Westra, Dozois, & Boardman, 2005). In addition, a meta-analysis of 47 studies found that outcome expectations at baseline predicted better treatment outcome (Constantino, Arnkoff, Glass, Ametrano, & Smith, 2011). Expectations for treatment have also been associated with adolescent treatment outcomes (Morrissey-Kane & Prinz, 1999). Changes in outcome expectations also mediate change in cognitive behavior therapy for generalized anxiety and seasonal affective disorder (Meyerhoff & Rohan, 2016; Newman & Fisher, 2010). Taken together, the existing literature has demonstrated that various measures of attitudinal engagement are predictors of treatment outcome.

Behavioral engagement appears be related to treatment outcome as well. For example, session attendance and tardiness have been associated with treatment outcome (Glenn et al., 2013; Miller & Prinz, 2003; Taft, Murphy, Elliott, & Morrel, 2001). Several studies have demonstrated that homework compliance is significantly associated with improved treatment outcomes for adolescents and adults with depression (Aguilera, Ramos, Sistiva, Wang, & Alegria, 2018; Conklin & Strunk, 2015; Cowan et al., 2008; Rees, McEvoy, & Nathan, 2005; Simons et al., 2012), anxiety (Hundt et al., 2014; Westra, Arkowitz, & Dozois, 2009), obsessive-compulsive disorder (Anand, Sudhir, Math, Thennarasu, & Janardhan Reddy, 2011), and substance use problems (Carroll et al., 2008). In addition, meta-analyses of CBT across several populations and problems have established a large effect size for the association between homework completion and treatment outcome (Kazantzis, Whittington, & Dattilio, 2010; Mausbach, Moore, Roesch, Cardenas, & Patterson, 2010). Additional results indicate that adherence to treatment recommendations are associated with improved outcomes. For example, Vincent and Hameed (2003) found that therapist-ratings of patient adherence significantly predicted outcomes immediately post-treatment, and a systematic review of CBT for insomnia found that increased adherence as rated by participants or therapists was associated with improved outcomes (Matthews, Arnedt, McCarthy, Cuddihy, & Aloia, 2013). Overall, existing research has demonstrated a relation between various metrics of behavioral engagement and treatment outcome.

Conceptual Framework of Treatment Engagement

As already highlighted, Staudt (2007) offered a conceptual framework for the association between treatment engagement and treatment outcome, which serves as the guide for this manuscript. First, the framework proposes that patient attitudinal engagement directly predicts treatment outcome. The rationale is that provider behaviors can reinforce patients' positive attitudes towards treatment—and such positive attitudes keep them in treatment and participating with treatment content, predicting improved treatment outcome. Second, the framework states that higher attitudinal engagement contributes to patient engagement in the behavioral aspects of treatment (e.g., showing up, doing homework)—and that behavioral engagement also contributes to improved treatment outcome. Staudt's (2007) framework emphasizes two key points. First, it identifies attitudinal engagement as the "heart" (Staudt, 2007, p. 189) of treatment engagement, highlighting that attitudinal engagement is essential. Second, it underscores that both attitudinal and behavioral engagement contribute to improved outcomes. Notably, the results from the and reviews noted above implicate treatment engagement as predictive of treatment outcomes, consistent with Staudt's (2007) framework.

Gaps, Goals, and Hypotheses

Although existing research has begun to illuminate the relation between both attitudinal and behavioral engagement and treatment outcome, several areas remain to be addressed. First, the existing literature on attitudinal engagement and treatment outcome includes a limited timeframe for both attitudinal engagement and treatment outcome. Specifically, most prior studies assess attitudinal engagement only at baseline (Westra et al., 2005) or measure treatment outcome only at post-treatment (Meyerhoff & Rohan, 2016; Newman & Fisher, 2010), resulting in a limited understanding of how attitudinal engagement predicts longer-term outcomes. Second, extant research includes samples diagnosed with one disorder—and focuses on only one treatment modality. Thus, generalizability is limited. Third, across prior studies the measures

used to assess treatment engagement are varied and inconsistent (Hock et al., 2015; Kim et al., 2012; Tetley, Jinks, Huband, & Howells, 2011). In fact, a systematic review of treatment engagement measurement identified 47 studies of engagement that utilized 40 different measures (Tetley et al., 2011). Fourth, to the best of our knowledge, no prior study has examined whether both attitudinal engagement and behavioral engagement predict treatment outcome within the same sample.

The present paper reports on three studies that address these gaps by including a relatively long follow-up period (6-12 months), by including multiple patient populations and treatments, by utilizing the same engagement measures across three studies, and by measuring both attitudinal and behavioral components of treatment engagement within the same study. The overarching goal is to expand on previous research by examining whether both attitudinal and behavioral treatment engagement predict treatment outcomes, via a systematic replication across three randomized controlled trials (RCT). We hypothesize that, in all studies, higher attitudinal engagement (measured as expectations for treatment) and higher behavioral engagement (measured as therapist ratings of patient adherence) will be associated with better treatment outcomes. Treatment outcome is operationalized as a reduction in symptoms and functional impairment.

The treatment outcome variables under investigation were selected because they were the primary outcomes for the three clinical trials from which the data for each study were drawn (Harvey et al., 2015, 2016, 2018). Table 1 presents descriptive statistics for each outcome measure from each study as well as correlations between the different measures. Although we considered removing some of the measures from each study in order to reduce multiple comparisons, we elected not to do so for three reasons. First, several of the outcome measures were not correlated with one another at various time points. Second, we wanted to maintain consistency across the studies reported in this paper. Third, we wanted to select measures that had already been preregistered as outcomes.

Study 1: RCT Treating Adults with Interepisode Bipolar Disorder and with Insomnia

Bipolar disorder is a chronic and impairing illness (Merikangas et al., 2011). Reduced need for sleep is both a symptom and a predictor of the onset of mania (American Psychiatric Association, 2013; Jackson, Cavanagh, & Scott, 2003). Both insomnia and hypersomnia are often experienced during depressive episodes (American Psychiatric Association, 2013). Also, during the interepisode period (i.e. the period between manic and depressive episodes), a majority of patients still report clinically significant sleep disturbance (Harvey, Schmidt, Scarnà, Semler, & Goodwin, 2005; Sylvia et al., 2012). Multiple lines of evidence highlight the negative contributions of sleep disturbance to bipolar disorder: it impairs quality of life and contributes to relapse as well as serious impairments in affect regulation, cognitive performance, and health (Harvey, Talbot, & Gershon, 2009). Therefore, treating sleep disturbance among people diagnosed with bipolar disorder is a clinical priority.

This study is a post-hoc reanalysis of data from a randomized controlled trial comparing cognitive behavior therapy for insomnia for bipolar disorder with psychoeducation (Harvey et al., 2015). The goal of the broader study was to evaluate the efficacy of cognitive behavior therapy for insomnia, adapted for bipolar disorder during the interepisode stage.

The first aim was to examine whether attitudinal engagement predicts treatment outcome at post-treatment. The hypothesis tested was that patients who report higher attitudinal

engagement —operationalized as higher credibility/expectancy scores—will exhibit, after treatment, fewer insomnia symptoms, higher sleep efficiency, and less functional impairment relative to those who report lower attitudinal engagement. The second aim was to whether behavioral engagement with treatment predicts treatment outcome at post-treatment and at 6-month follow-up. Specifically, we predicted that patients who were rated as more behaviorally engaged—operationalized as rated as more adherent by therapists—will exhibit fewer insomnia symptoms, higher sleep efficiency, and less functional impairment relative to patients rated as less engaged at post-treatment and at 6-month follow-up.

Method

Participants

Participants were 58 adults with interepisode bipolar disorder and insomnia drawn from a National Institute of Mental Health funded RCT comparing cognitive behavior therapy for insomnia adapted for bipolar disorder with psychoeducation (Harvey et al., 2015). Table 2 presents the demographic information.

Individuals were eligible if they met the following inclusion criteria: (a) diagnosis of bipolar disorder, according to DSM-IV-TR criteria (American Psychiatric Association, 2000), (b) interepisode, as defined by a Young Mania Rating Scale (Young, Biggs, Ziegler, & Meyer, 1978) score < 12 and an Inventory of Depressive Symptomatology, Clinician-Rated (Rush, Gullion, Basco, Jarrett, & Trivedi, 1996) score < 24 for the past week, (c) met general criteria for insomnia as defined by the International Classification of Sleep Disorders, 2nd Edition (American Academy of Sleep Medicine, 2005) and DSM-IV-TR criteria for primary insomnia without the exclusion for mental disorders via the Duke Structured Interview for Sleep Disorders (DSISD; Edinger et al., 2004), (d) had a stable medication regimen for the past four weeks, (e) had a treating psychiatrist, and (f) were fluent in English.

Exclusion criteria were as follows: (a) alcohol or substance abuse/dependence over the past three months; (b) current posttraumatic stress disorder; (c) active or progressive physical illness directly related to the onset and course of insomnia; (d) sleep apnea, restless legs syndrome or periodic limb movement disorder on the basis of the DSISD; (e) current suicidal or homicidal risk; (f) pregnancy or current breast-feeding; and (g) overnight shift work in the past three months.

Treatment

Treatment was provided by doctoral or masters level therapists. Supervision was provided by a licensed clinical psychologist (AGH). Treatment was delivered in eight, weekly, 50-minute sessions.

Cognitive Behavior Therapy for Insomnia for Bipolar Disorder (CBTI-BP). Cognitive behavior therapy for insomnia, with modifications specifically for bipolar disorder, was delivered. Content covered included case formulation, goal setting, sleep and circadian education, along with behavioral interventions (stimulus control, sleep restriction, devising a "wind down" of 30-60 minutes in which relaxing sleep-enhancing activities are introduced in dim-light conditions, and devising a wake-up routine), cognitive interventions (energy-generating behavioral experiments, identification of energy-generating and energy-sapping activities), and relapse prevention.

Psychoeducation (PE). PE provided information but did not facilitate behavior change. Educational material focused on a model in which sleep, stress, diet, health, exercise, and mood are interrelated and have reciprocal effects.

Procedure

All procedures were approved by the University of California, Berkeley, Committee for the Protection of Human Subjects. All participants provided informed consent. This trial was registered (NCT00993850).

Eligible participants were randomly assigned to receive CBTI-BP ($N = 30$) or PE ($N = 28$). Both groups received 8 sessions of therapy. At the end of each treatment session therapists completed a measure of participant behavioral engagement in treatment (TARS). At pre-treatment and post-treatment, participants completed a measure of attitudinal engagement in treatment (CEQ). At pre-treatment, post-treatment, and six-month follow-up, participants completed measures of insomnia, sleep efficiency, and functional impairment. Further details regarding treatment content, rationale, and fidelity can be found in Harvey et al. (2015).

Outcome Measures

Insomnia Severity Index (ISI). The ISI, a brief assessment of nighttime variables and daytime variables, was administered at pre-treatment, post-treatment, and 6-month follow-up. It has excellent internal consistency (Cronbach's alpha = 0.91), good temporal stability ($r = 0.80$), and has been validated against the gold-standard objective measure of sleep, polysomnography, as well as the gold-standard subjective measure, sleep diary (Bastien, Valliers, & Morin, 2001).

Sleep efficiency (SE). SE, calculated from the sleep diary, is a subjective measure of sleep recommended for use as a standard measure for use during sleep research (Buysse, Ancoli-Israel, Edinger, Lichstein, & Morin, 2006; Carney et al., 2012). It was collected at pre-treatment, post-treatment, and 6-month follow-up. From the sleep diary, researchers can calculate time in bed (time spent in bed regardless of awakenings) as well as total sleep time (TST; calculated as time in bed minus early morning awakenings, awakenings during the night, and the time it takes to fall asleep). SE is calculated by dividing TST by time in bed and multiplying the value by 100 percent.

Sheehan Disability Scale (SDS). Functional impairment was measured at pre-treatment, post-treatment, and 6-month follow-up via the SDS, which assessed mood- and sleep-related impairment (Sheehan, Harnett-Sheehan, & Raj, 1996). The SDS evaluates the extent to which work/school, social life, and home/responsibilities are impaired on a 0-10 (not at all to extremely) scale. Its psychometric properties are well-established.

Engagement Measures

Attitudinal Engagement: Credibility/Expectancy Questionnaire (CEQ). The CEQ (Borkovec & Nau, 1972) is a self-report measure used in prior research to assess attitudinal engagement (Hock et al., 2015). It was administered at pre-treatment and at post-treatment. It has demonstrated high internal consistency (Devilly & Borkovec, 2000; Devilly & Spence, 1999). It includes five items that are rated on a Likert-scale from 1 to 10. Minor study-specific adaptations to the CEQ were completed. Items asked about "sleep treatment" and "sleep symptoms." The fifth item at post-treatment was written as "How much improvement has occurred in your sleep problems since the beginning of treatment?" Because this fifth item was written in a way that assessed treatment outcome (e.g., ratings in improvement in symptoms), rather than assessing

treatment engagement (e.g., expectations), only the first four items were included in analyses. The first four CEQ items were summed to create a total score.

Behavioral Engagement: Treatment Adherence Rating Scale (TARS). Previous research has established that adherence to treatment recommendations is a form of behavioral engagement (Lindsey et al., 2014). The TARS is a 5-item therapist-reported measure of adherence based on Lichstein et al.'s (1994) treatment implementation model. It has good test-rest reliability and high internal consistency (Dolsen et al., 2017; Dong, Soehner, Bélanger, Morin, & Harvey, 2018). Therapists completed this measure at the end of each treatment session. Scores for every item at each session were summed and the mean across sessions was used.

Data Analysis

Analyses were calculated using Stata 15 (StataCorp, 2017). A significance level of 0.05 was used throughout. All measures were standardized within each time point. Hierarchical linear modeling using restricted maximum likelihood estimation was used to examine the relation between treatment engagement as measured by the CEQ and TARS over time with the measures of symptom severity (ISI, SE) and functional impairment (SDS). Treatment condition was included as a covariate in the fixed part of the model. The random part of the model included a random intercept for participant, assumed to have a bivariate normal distribution with a mean of zero and an unstructured covariance matrix.

Results

Results are displayed in Table 3. Increased attitudinal engagement was associated with a reduction in ISI scores at post-treatment (*Beta* = -0.51, *SE* = 0.17, *p* = 0.00). Attitudinal engagement was not associated with a change in SE scores at post-treatment, nor was it associated with a change in functional impairment at post-treatment.

Behavioral engagement was not associated with a change in the symptom or impairment outcomes at post-treatment or 6-month follow-up.

Discussion

Our first aim was to examine whether attitudinal engagement predicted sleep and functional impairment outcomes in a sample of adults with interepisode bipolar disorder and insomnia. In partial support of our hypothesis, higher attitudinal engagement predicted a reduction in ISI scores at post-treatment. This finding is consistent with previous research indicating that expectations for treatment predict treatment outcome immediately following treatment (e.g., Constantino et al., 2011), and highlights the importance of patient buy-in at the start of treatment. Inconsistent with our hypothesis, attitudinal engagement was not associated with SE or with functional impairment. In hindsight, although SE was a primary outcome for the "parent" study, it may not be the best variable to measure insomnia in bipolar disorder. As individuals with bipolar disorder often do not spend sufficient time in bed to sleep, SE is often relatively high (Eidelman, Talbot, Gruber, & Harvey, 2010). In terms of functional impairment, most prior studies included only single items to assess functional impairment (Meyerhoff & Rohan, 2016; Newman & Fisher, 2010; Westra et al., 2005), whereas this is one of the first studies to use a multi-item measure of functional impairment to examine association with attitudinal engagement.

Contrary to our second hypothesis, behavioral engagement was not associated with any of the treatment outcome measures. This result is inconsistent with prior research that has demonstrated that therapist ratings of patient adherence to recommendations for treatment for insomnia are associated with improved outcomes (Matthews et al., 2013; Vincent & Hameed, 2003). We offer two possible interpretations. First, this sample included individuals with bipolar disorder and insomnia, a different diagnostic group from prior studies. Second, prior research included a single, global rating of adherence describing the duration of treatment (Vincent & Hameed, 2003). In this study, we averaged ratings collected at each session. Perhaps averaging ratings lost some of the variability, potentially resulting in null findings

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Study 2: RCT of Cognitive Therapy for Adults with Depression

Study 2 extends Study 1 in two ways. First, a measure of attitudinal engagement was included at the follow-up assessment. Second, Study 2 includes a different patient population and different treatment. In short, we conducted a post-hoc reanalysis of data drawn from a different patient population receiving a different treatment and we included a measure of attitudinal engagement at follow-up in order to examine whether the treatment engagement findings were similar or different from those of Study 1.

The sample included adults with major depressive disorder participating in a RCT comparing cognitive therapy-as-usual with cognitive therapy plus a novel Memory Support Intervention (Harvey et al., 2014, 2016). Depression is one of the most prevalent mental disorders and a leading cause of disability worldwide (Murray et al., 2012; Vos et al., 2012). The majority of patients who recover from depression will relapse (Eaton et al., 2008). Although cognitive therapy is a widely studied, evidence-based, and frontline treatment for depression (Cuijpers, Berking, et al., 2013; Cuijpers, Hollon, et al., 2013), room still remains for improvement (Bockting, Hollon, Jarrett, Kuyken, & Dobson, 2015; Jarrett et al., 2013). The goal of this RCT was to evaluate whether the Memory Support Intervention could improve patient memory for treatment and patient outcomes.

The first aim was to examine whether attitudinal engagement predicts treatment outcome at post-treatment and at follow-up. The hypothesis was that patients who report higher attitudinal engagement—operationalized as higher credibility/expectancy scores—would experience fewer depression symptoms and better overall functioning at post-treatment and at 6-month follow-up relative to those who report lower expectations for treatment. The second aim was to examine whether behavioral engagement with treatment predicts treatment outcome at post-treatment and 6-month follow-up. The hypothesis was that patients who were rated as more behaviorally engaged —operationalized as rated as more adherent by therapists—would experience fewer depression symptoms and better overall functioning relative to those rated as less behaviorally engaged at post-treatment and 6-month follow-up.

Method

Participants

Participants were 48 adults who met diagnostic criteria for major depressive disorder (MDD) drawn from a National Institute of Mental Health-funded RCT comparing cognitive therapy-as-usual (CT-as-usual) to cognitive therapy with an adjunctive memory support

intervention (CT+Memory Support) (Harvey et al., 2016). Table 2 presents the demographic characteristics.

Individuals were eligible if they met the following inclusion criteria: (a) diagnosis of MDD, regardless of chronicity or recurrence, according to DSM-IV-TR criteria (American Psychiatric Association, 2000); (b) a score of 26 or above on the Inventory of Depressive Symptomatology, Self-Report (IDS-SR) (Rush et al., 1996), (c) a score of 24 or above on the Inventory of Depressive Symptomatology, Clinician-Rated (IDS-C) (Rush et al., 1996), (d) 18 years of age or older; (e) medications for mood must have been stable for the past four weeks, and (f) able and willing to give informed consent.

Individuals were excluded if they met any of the following criteria: (a) history of bipolar affective disorder; (b) history of psychosis or psychotic features; (c) current non-psychotic Axis I disorder that constituted the principal diagnosis (defined below) requiring treatment other than that offered within the study; (d) history of substance dependence in the past six months; (e) IQ below 80; (f) evidence of any medical disorder or condition that could cause depression or preclude participation in CT (or that is associated with memory problems); or (g) current suicide risk sufficient to preclude treatment on an outpatient basis. "Principal" diagnosis was defined as the disorder currently most distressing and disabling, using a widely accepted severity rating scale capturing distress and interference (Di Nardo, Moras, Barlow, Rapee, & Brown, 1993).

Treatment

Therapy was delivered by licensed therapists or therapists working towards licensure. Weekly supervision was conducted by a licensed clinical psychologist (AGH).

Cognitive Therapy-as-usual (CT-as-usual). CT was first described by Aaron T. Beck and colleagues (Beck, 1979) and is based on cognitive theories of depression. It was conducted according to published manuals.

Cognitive Therapy with Memory Support (CT+Memory Support). Participants in this condition received CT with an additional Memory Support Intervention. The Memory Support Intervention is derived from the cognitive psychology and education literatures based on carefully honed criteria (Harvey et al., 2014). These memory-promoting strategies are strategically and intensively integrated into treatment-as-usual to promote the encoding of treatment contents. This intervention does not lengthen session time or increase the number of sessions required. Memory support strategies are delivered alongside a treatment point, which was defined as a "main idea, principle, or experience that the treatment provider wants the patient to remember or implement as part of the treatment" (Lee & Harvey, 2015). Therapists in the CT+Memory Support condition received training in the Memory Support Intervention as well as training in CT-as-usual.

Procedure

All procedures were approved by the University of California, Berkeley, Committee for the Protection of Human Subjects. All participants provided informed consent. This trial was registered (NCT01790919).

Eligible participants were randomly assigned to receive cognitive therapy-as-usual (CT-as-usual) ($N = 23$) or cognitive therapy with memory support (CT+Memory Support) ($N = 25$). Regardless of treatment group, all participants received 14 sessions of therapy. At pre-treatment, post-treatment, and six-month follow-up, participants completed measures of depression symptoms, functional impairment, and attitudinal engagement in treatment (CEQ). At the end of

each treatment session therapists completed a measure of participant behavioral engagement in treatment (TARS). Further details regarding treatment content, rationale, and fidelity can be found in (Harvey et al., 2016).

Outcome Measures

Inventory of Depressive Symptomatology – Self-Report (IDS-SR). Depression symptom severity was measured using the IDS-SR at pre-treatment, post-treatment, and 6-month follow-up. The IDS-SR is a 30-item measure of depression symptoms over the past 7 days. It has excellent internal consistency (Cronbach's alpha = 0.92) (Trivedi et al., 2004).

Global Assessment of Functioning (GAF). The GAF is an assessor rating of 0 to 100, with lower scores indicating greater impairment (American Psychiatric Association, 2000).

Engagement Measures

CEQ. The CEQ in Study 2 was the same as in Study 1, except that it asked about "therapy" and "depression symptoms." It was administered at pre-treatment, post-treatment, and 6-month follow-up.

TARS. The same measure used in Study 1 was used in Study 2.

Data Analysis

The approach in Study 2 was parallel to the approach used as in Study 1. In this study, the IDS-SR was included as the measure of symptom severity and the GAF was included as the measure of functional impairment.

Results

Results are presented in Table 4. Increased attitudinal engagement was associated with a reduction in IDS-SR scores at post-treatment (*Beta* = -0.60, *SE* = 0.15, $p<0.001$) and at 6-month follow-up (*Beta* = -0.40, *SE* = 0.16, $p = 0.01$). Attitudinal engagement was associated with GAF scores at pre-treatment (*Beta* = 0.40, *SE* = 0.14, $p < 0.01$), but was not associated with a change in GAF scores at post-treatment or at 6-month follow-up.

Increased behavioral engagement was associated with improved GAF scores at post-treatment (*Beta* = 0.42, *SE* = 0.17, $p = 0.02$) and at 6-month follow-up (*Beta* = 0.45, *SE* = 0.17, $p < 0.01$). Behavioral engagement was not associated with a change in IDS-SR scores at post-treatment or 6-month follow-up.

Discussion

Consistent with our hypothesis, increased attitudinal engagement predicted a reduction in depression symptoms at post-treatment and 6-month follow-up. These findings are consistent with prior research establishing a relation between attitudinal engagement and treatment outcome immediately following treatment (Constantino et al., 2011). The results extend our understanding of the relation between attitudinal engagement and longer-term outcomes, as the present study included a 6-month follow-up assessment. Also in support of our hypothesis, attitudinal engagement was associated with the GAF, a measure of functional impairment, at baseline, but not with a change in symptoms at post-treatment or 6-month follow-up. This result is parallel to the findings from Study 1 and suggests that attitudinal engagement may be more related to

changes in symptoms rather than change in impairment. Perhaps having higher expectations for treatment contributes to patients incorporating skills focused on symptom reduction into their lives. Taken together, the results from this study provide support for the relation between attitudinal engagement and selected treatment outcomes.

In partial support of our second hypothesis, higher behavioral engagement predicted an improvement in functional impairment at post-treatment and 6-month follow-up. This finding is consistent with existing research demonstrating a relation between behavioral engagement and treatment outcomes (Kazantzis et al., 2010; Matthews et al., 2013). Contrary to our hypothesis, behavioral engagement was not associated with a change in depression symptoms. This result was surprising as prior research has demonstrated that higher behavioral engagement is associated with a reduction in depression symptoms (Cowan et al., 2008; Rees et al., 2005). One explanation may be that identifying participant adherence to some of the cognitive elements of CBT (e.g., reducing rumination, shifting core beliefs) may be more challenging for a therapist to recognize. Alternatively, attitudinal engagement and symptoms were both measured via self-report, and behavioral engagement and impairment were measured via observer-report (therapist or diagnostic assessor), which may be a function of shared method variance.

Study 3: RCT of Sleep and Circadian Treatment for Adolescents with an Evening Circadian Preference

Study 3 extends Study 1 and Study 2 in four ways. First, the sample is larger ($N = 176$ relative to $N = 58$ for Study 1 and $N = 48$ for Study 2). Second, both Studies 1 and 2 include samples of adults but Study 3 includes a sample of adolescents. Third, it increases generalizability by examining a different treatment relative to Studies 1 and 2. Fourth, Study 3 includes an additional measure of behavioral engagement—tardiness—which has been used as an indicator of youth treatment engagement in prior research (Miller & Prinz, 2003; Sinclair, Christenson, Evelo, & Hurley, 1998).

This third study comprises a sample of adolescents with an evening circadian preference ("night owls"). Individuals with an evening circadian preference have a preference for going to bed later and waking later (Carskadon, Vieira, & Acebo, 1993; Roenneberg et al., 2004). Approximately 40% of adolescents experience a shift towards an evening circadian preference, which coupled with early school start times, contributes to a cycle of insufficient sleep during adolescence (Crowley, Acebo, & Carskadon, 2007; Crowley, Wolfson, Tarokh, & Carskadon, 2018; Roenneberg et al., 2004). An evening circadian preference is associated with an increase in risk for a host of negative outcomes such as affective problems including depression, anxiety, emotional instability, and suicidality (Fares et al., 2015; Goldstein, Bridge, & Brent, 2008; Gregory & Sadeh, 2012); substance use and impulsivity (Adan, Natale, Caci, & Prat, 2010; Hasler, Soehner, & Clark, 2016); aggressive and antisocial behavior (Díaz-Morales, Escribano, Jankowski, Vollmer, & Randler, 2014; Schlarb, Sopp, Ambiel, & Grünwald, 2014); poor academic performance (Preckel, Lipnevich, Schneider, & Roberts, 2011; Short, Gradisar, Lack, Wright, & Dohnt, 2013); and high body mass index and obesity (Asarnow, Greer, Walker, & Harvey, 2017; Malone et al., 2016). Hence, understanding the connection between treatment engagement and treatment outcome is imperative in this high-risk population.

The present study was conducted as a post-hoc reanalysis of data drawn from a RCT comparing the Transdiagnostic Sleep and Circadian Intervention (TranS-C; Harvey & Buysse, 2017), an intervention designed to modify the behavioral and psychosocial contributors to an

evening circadian preference, vs. psychoeducation among adolescents with an evening circadian preference. The goal of the broader study was to reduce the evening circadian preference and improve health in adolescents (Harvey et al., 2018).

The first aim was to examine whether attitudinal engagement predicts treatment outcome. The hypothesis tested was that adolescents who report higher attitudinal engagement—operationalized as higher credibility/expectancy scores—would have longer total sleep time, earlier bedtimes, and less of an evening circadian preference relative to adolescents with lower attitudinal engagement at post-treatment, 6-month follow-up, and 12-month follow-up. The second aim was to examine whether behavioral engagement with treatment predicts treatment outcome. The hypothesis tested was that adolescents who were rated as more behaviorally engaged—operationalized as rated as more adherent by therapists and less tardiness to treatment sessions—would experience longer total sleep time, earlier bedtimes, and less of an evening circadian preference relative to adolescents who were rated as less adherent and who were late to more sessions at post-treatment, 6-month follow-up, and 12-month follow-up. The third aim was to examine whether the interaction between attitudinal and behavioral engagement predicts treatment outcome. The hypothesis tested was that adolescents who report higher attitudinal engagement and who were rated as more behaviorally engaged would experience longer total sleep time, earlier bedtimes, and less of an evening circadian preference relative to adolescents who report lower attitudinal engaged and/or who were rated as less behaviorally engaged.

Method

Participants

Participants were 176 adolescents drawn a NICHD-funded treatment trial designed to reduce the evening circadian preference and improve health in adolescents (Harvey et al., 2018). Table 2 presents the demographic characteristics.

Participants were eligible if they (a) were between 10 and 18 years old, living with a parent or guardian, and attending a class/job by 9am at least three days per week; (b) were fluent in English; (c) were able and willing to give informed assent; (d) reported an evening circadian preference as demonstrated by scoring in the lowest quartile on the Children's Morningness-Eveningness Preference Scale (CMEP; 27 or lower), had a 7-day sleep diary showing a sleep onset time of 10:40pm or later for 10-13 year olds, 11pm or later for 14-16 year olds, and 11:20pm or later for 17-18 year olds at least three nights per week, and this pattern had to be present for at least three months; and (e) fell in the "at-risk" range on measures in at least one of five health domains (behavioral, cognitive, emotional, social, physical) described in greater detail elsewhere (Harvey et al., 2018).

Individuals were excluded if there was (a) an active, progressive physical illness or neurodegenerative disease directly related to the onset and course of the sleep disturbance; (b) evidence of obstructive sleep apnea, restless leg syndrome, or periodic limb movement disorder; (c) significantly impairing pervasive developmental disorder; (d) bipolar disorder, schizophrenia, or another Axis I disorder, when there was risk for harm if treatment were delayed; (e) a history of substance abuse in the past six month; or (f) current suicide risk to preclude treatment on an outpatient basis. Individuals ceased taking medications that alter sleep (e.g., hypnotics) four weeks prior to the assessment (two weeks for melatonin) or were excluded.

Treatment

Treatment was provided by doctoral or masters level therapists. Weekly supervision was conducted by a licensed clinical psychologist (AGH). Treatment was delivered in six weekly 50-minute sessions.

Transdiagnostic Sleep and Circadian Intervention (TranS-C). TranS-C (Harvey & Buysse, 2017) includes four cross-cutting modules featured in every session, four core modules that apply to the vast majority of participants, and seven optional modules used less commonly, depending on the presentation.

Psychoeducation (PE). PE is an active comparison treatment associated with sleep improvement (Harvey et al., 2015). These sessions focused on the relation between sleep, stress, diet, health, exercise, accidents, and mood. Participants also had the option to sample yoga, meditation, and/or outdoor appreciation. The emphasis was on providing information but not on facilitating behavior change.

Text Messaging Intervention. As described in detail elsewhere (Dolsen, Dong, & Harvey, under review), at the 6-month follow-up, adolescents were randomly assigned to receive 24 text messages reminding them of treatment information, 24 text messages prompting them to recall treatment information, or no text messages (or did not participate in this portion of the study). The text messaging conditions were informed by increasing evidence that memory support strategies can enhance memory for treatment, which is associated with improved treatment outcome (Dong, Lee, & Harvey, 2017; Harvey et al., 2014, 2016).

Procedure

All procedures were approved by the University of California, Berkeley, Committee for the Protection of Human Subjects. All participants provided informed consent or assent. This trial was registered (NCT01828320 and NCT02961400).

Eligible adolescents participated in two treatment phases. In the first phase, participants were randomly assigned to receive either TranS-C ($N = 89$) or Psychoeducation ($N = 87$). Regardless of treatment group, all participants received six treatment sessions. At pre-treatment, post-treatment, 6-month follow-up, and 12-month follow-up, adolescents completed measures of sleep and circadian functioning and of attitudinal engagement in treatment. At the end of each treatment session therapists completed measures of adolescent behavioral engagement in treatment. For the second treatment phase, delivered between the 6-month and 12-month follow-ups, adolescents were randomly assigned to receive text messages reminding them of treatment information (n=47), text messages prompting them to recall treatment information (n=50), no text messages (n=47), or did not participate in this portion of the study (n=32) (Dolsen et al., n.d.). Further details regarding treatment content, rationale, and fidelity can be found in Harvey et al. (2018).

Sleep and Circadian Outcome Measures

Sleep Diary. A daily sleep diary is the gold standard subjective measure of sleep (Buysse et al., 2006). A 7-day sleep diary (Carney et al., 2012) was collected over the phone by a trained research assistant at pre-treatment, post-treatment, 6-month follow-up, and 12-month follow-up. Weeknight bedtime (BT) and total sleep time (TST) were established as the variables of interest. BT was determined by asking "What time did you get into bed last night?" TST was calculated by subtracting wake time (WUT: "What time was your final awakening?"), and total wake time (TWT: sleep onset latency: "How long did it take you to fall asleep?" + wake after sleep onset:

"How many times did you wake up after falling asleep? How long did each awakening last?") from bedtime (TST: BT-WUT-TWT).

Children's Morningness-Eveningness Preference Scale (CMEP). The CMEP is a 10-item self-report measure of circadian preference. It assesses timing preference for certain activities. Scores range from 10 (extreme evening preference) to 42 (extreme morning preference) (Carskadon et al., 1993). The CMEP was administered at pre-treatment, post-treatment, 6-month follow-up, and 12-month follow-up.

Engagement Measures

CEQ. The CEQ was the same as in Study 1 and Study 2, except that it asked about "sleep coaching," the term we used to discuss our sleep treatment with youth, and "sleep problems." It was administered at pre-treatment, post-treatment, and 6-month follow-up.

TARS. The TARS was the same as in Study 1 and Study 2. However, individual items were missing on this scale for a few participants/therapists. To account for the missing data, scored items for each treatment session were averaged for each individual treatment session and then were averaged across all sessions to create a total TARS score.

Tardiness. Given the large sample size, we elected to include this additional, available measure of behavioral engagement. Participant tardiness to treatment sessions was recorded by therapists on a session attendance log at the end of each treatment session. The total number of times each adolescent was late was summed to create a total score ranging from 0-6.

Data Analysis

The approach in this study was parallel to that in Studies 1 and 2. In this study, TST, bedtime, and CMEP were included as the measures of symptoms. The CEQ was included as the measured of attitudinal engagement. The TARS and Tardiness were included as the measures of behavioral engagement. Treatment condition, text messaging condition, age, and sex were included as covariates in the fixed part of each model.

Results

Results are displayed in Table 5. Increased attitudinal engagement was associated with an increase in CMEP scores at post-treatment (*Beta* = 0.34, *SE* = 0.09, $p < 0.001$), 6-month follow-up (*Beta* = 0.23, *SE* = 0.08, $p = 0.01$), and at 12-month follow-up (*Beta* = 0.33, *SE* = 0.10, $p < 0.01$), indicating a reduction in an evening circadian preference. Attitudinal engagement was not associated with a change in TST or bedtime.

Behavioral engagement as measured by the TARS was not associated with TST at any other time points or with bedtime or CMEP. Behavioral engagement measured by lateness to sessions was not significantly associated with TST, bedtime, or CMEP.

The interaction of attitudinal engagement as measured by the CEQ and behavioral engagement as measured by the TARS was not significantly associated with TST, bedtime, or CMEP at any time point.

Discussion

In partial support of our first hypothesis, higher attitudinal engagement was associated with a reduction in evening circadian preference. However, contrary to our hypothesis,

attitudinal engagement was not associated with TST or bedtime. One explanation is that the measure of circadian preference was associated with the largest pre-post treatment change, relative to TST and bedtime, in the primary trial from which these data are drawn (Harvey et al., 2018). Thus, it was the outcome with the most variance to explain.

Behavioral engagement, measured via both the TARS and tardiness, was not associated with treatment outcome. Although inconsistent with our hypothesis, these results replicate the results from Study 1. We offer three possible explanations. First, there is a great deal of support for the relation between homework compliance and treatment outcome (Anand et al., 2011; Cowan et al., 2008; Mausbach et al., 2010). These studies all used different metrics to index homework compliance such as tracking worksheet completion and following day-to-day completion of homework. In contrast, in this study, only one item on the TARS captures homework compliance. Second, adolescent tardiness may reflect parent/caregiver engagement or logistical problems, as adolescents often rely on parents/caregivers for transportation to treatment (Nock & Kazdin, 2005). Third, a substantial portion of the prior literature examining the link between therapist-rated adherence and treatment outcome has focused on adults, not adolescents (e.g, Kazantzis et al., 2010; Matthews et al., 2013; Vincent & Hameed, 2003). Perhaps adolescent behavioral engagement is different from that of adults.

Contrary to our third hypothesis, the interaction between attitudinal engagement and behavioral engagement measured via the TARS did not predict treatment outcome. This finding raises the possibility that attitudinal engagement and behavioral engagement are largely separate constructs that act on treatment outcome independently, a view that is inconsistent with Staudt's (2007) framework.

General Discussion

Overall, this three-study investigation adds to the current literature on, and highlights the importance of, attitudinal engagement. The pattern of findings indicating that attitudinal engagement is associated with symptom improvement was consistent across the three diverse samples. These finding are in line with prior research (Dearing et al., 2005; Morrissey-Kane & Prinz, 1999; Newman & Fisher, 2010). We observed these same results when the follow-up period was extended. Future research is needed to further investigate the surprising finding that attitudinal engagement was not associated with several symptom measures or with functional impairment. Perhaps attitudinal engagement changes week-by-week across the course of treatment (Meyerhoff & Rohan, 2016). Nonetheless, the results from all three studies are consistent with Staudt's (2007) framework, as they provide additional empirical evidence across three disparate samples that treatment expectations contribute to treatment change on selected measures. Clinically, the results are consistent with the view that addressing patient expectations for treatment may be particularly beneficial for promoting and sustaining treatment outcomes (Lindsey et al., 2019). For example, addressing and setting expectations for treatment have been embedded into evidence-based interventions such as dialectical behavior therapy (Lindenboim, Lungu, & Linehan, 2017).

This series of studies also extends our understanding of behavioral engagement. As prior research has demonstrated that behavioral engagement is associated with treatment outcome (Kazantzis et al., 2010; Matthews et al., 2013; Vincent & Hameed, 2003), it is surprising that this relation was present only in Study 2, with a significant association between greater behavioral engagement and an improvement in functional impairment for depression. One explanation is

that the TARS, which was used across the three studies, draws on multiple domains of the broader construct of treatment adherence that include treatment receipt, treatment enactment, and homework compliance (Lichstein et al., 1994). Perhaps only select portions of these various domains of treatment adherence are closely linked to outcomes. To consider this possibility further, we conducted exploratory post-hoc analyses to examine the three TARS subscales. Results varied across the studies. Treatment receipt was significantly associated with an improvement on the SDS-Mood scores from baseline to post-treatment and 6-month follow-up in Study 1 (*Beta* = -0.29, *SE* = 0.04, *p* = 0.04), but was not significantly associated with treatment outcome in Studies 2 and 3. Treatment enactment was significantly associated with better SDS-Sleep scores in Study 1 (*Beta* = -0.28, *SE* = 0.14, *p* = 0.04) and with a reduction in IDS-SR scores from baseline to post-treatment on the in Study 2 (*Beta* = -0.32, *SE* = 0.15, *p* = 0.03), but was not significantly associated with treatment outcome in Study 3. Homework compliance was significantly associated with improved GAF scores in Study 2 (*Beta* = -0.38, *SE* = 0.15, *p* = 0.02) and with a reduction in TST from baseline to post-treatment in Study 3 (*Beta* = -0.26, *SE* = 0.03, *p* = 0.04), but was not significantly associated with treatment outcome in Study 1. Alternatively, and particularly because the subscale analyses also provide mixed findings, perhaps the relation between therapist-rated adherence and treatment outcome is not as robust as other metrics of behavioral engagement. This explanation is consistent with a meta-analysis showing that the association between patient-rated adherence and treatment outcome had a larger effect size than therapist-rated adherence (Mausbach et al., 2010). Overall, the behavioral engagement results are not aligned with Staudt's (2007) framework, as this framework posits that greater adherence to treatment recommendations would contribute to improved outcomes. To better understand these findings, further research is needed with larger, heterogenous samples of both youth and adults and with additional measures of behavioral engagement from multiple sources.

The results should be interpreted within the confines of several limitations. First, this manuscript measured only one domain of attitudinal engagement across all three studies and one dimension of behavioral engagement in Studies 1 and 2 and two types of behavioral engagement in Study 3. Future research should include multiple domains of attitudinal and behavioral engagement. Second, attitudinal engagement was measured via self-report whereas behavioral engagement was measured via therapist-report. Future work should include multiple informants for both attitudinal and behavioral engagement. Third, Study 3 did not include a measure of functional impairment, and Studies 1 and 3 included only self-report outcome measures. Future studies should consider including objective measure of sleep (e.g., actigraphy). Fourth, treatment outcome was assessed only before and after treatment, so we cannot report on the association between symptoms/impairment and treatment engagement on a session-by-session basis (Meyerhoff & Rohan, 2016). Future research should include symptom scales at each treatment session. Fifth, the samples sizes for Studies 1 and 2 were small and multiple comparisons were used. Based on Nakagawa and Cuthill (2007), corrections for multiple corrections (e.g., Bonferroni) further reduce power, increase the likelihood of Type II error, and contribute to publication bias. Therefore, we included effect sizes as suggested by Nakagawa and Cuthill (2007) rather than correcting for multiple comparisons. Standardized coefficients, as presented, are interpretable as effect sizes (Lorah, 2018; Snijders & Bosker, 2012). Sixth, this manuscript did not assess the potential pathway between attitudinal engagement and behavioral engagement proposed by Staudt's (2007) framework. Future research with larger samples should test this pathway. Seventh, this investigation did not assess therapeutic working alliance, which has been extensively studied (e.g., Doran, 2016) and may impact treatment engagement (Staudt, 2007).

Eighth, this series of studies included several unique patient populations, yet we cannot generalize to other patient populations and diagnostic groups. Finally, data were drawn from participants recruited to participate studies in university settings, which reduces generalizability. Additional research is needed in routine care settings.

Taken together, findings from this three-study investigation build on prior research and provide evidence that both attitudinal engagement and behavioral engagement contribute to selected treatment outcome measures. These studies are some of the first to examine the association both attitudinal and behavioral engagement with treatment outcome within the same samples as opposed to a single component of treatment engagement, which advances the conceptual model proposed by Staudt (2007), as this model implicates both attitudinal and behavioral engagement as contributors to treatment outcome. The results are important as they underscore the idea that patients may need to invest themselves in treatment, beyond perfunctorily showing up. The results have implications for developing and adapting interventions designed to improve treatment engagement (Becker et al., 2015; Lindsey et al., 2014). Targeting attitudinal engagement, specifically expectations for treatment, may be particularly valuable. Additionally, considering treatment engagement is particularly important as interventions are increasingly implemented in routine mental health care settings (McKay et al., 2004). Overall, this series of studies demonstrates that treatment engagement may contribute to treatment outcome.

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Table 1

Descriptive Statistics of Study Variables

Variables	Mean	SD	Correlations (*r*)			
Study 1: Adults with interepisode bipolar disorder and insomnia			1	2	3	4
Outcome measures at pre-treatment						
1. ISI	18.31	4.28	-			
2. SE (%)	81.04	8.99	-0.36*	-		
3. SDS-Mood	4.22	2.57	0.23	-0.12	-	
4. SDS-Sleep	4.75	2.37	0.31	-0.00	0.69**	-
Outcome measures at post-treatment						
1. ISI	9.96	6.46	-			
2. SE (%)	86.60	9.31	0.49**	-		
3. SDS-Mood	2.92	2.43	0.31*	-0.05	-	
4. SDS-Sleep	2.93	2.42	0.34*	-0.01	0.45*	-
Outcome measures at 6-month follow-up						
1. ISI	9.51	6.36	-			
2. SE (%)	87.41	7.46	0.42*	-		
3. SDS-Mood	2.66	2.36	0.66***	0.48**	-	
4. SDS-Sleep	2.74	2.35	0.58***	0.05	0.58***	-
Study 2: Adults with major depressive disorder			1	2		
Outcome measures at pre-treatment						
1. IDS-SR	41.19	9.23	-			
2. GAF	59.51	4.59	-0.33*	-		
Outcome measures at post-treatment						
1. IDS-SR	22.29	11.56	-			
2. GAF	69.24	8.72	-0.51***	-		
Outcome measures at 6-month follow-up						
1. IDS-SR	23.12	13.30	-			
2. GAF	70.44	11.54	-0.80***			
Study 3: Adolescents with an evening circadian preference			1	2	3	
Outcome measures at pre-treatment						
1. TST	457.05	63.11	-			
2. Bedtime	22.93	1.06	0.66***	-		
3. CMEP	21.30	3.81	0.07	-0.09	-	
Outcome measures at post-treatment						
1. TST	473.66	79.55	-			
2. Bedtime	22.94	1.05	0.46***	-		
3. CMEP	24.25	4.89	0.17*	0.35***	-	
Outcome measures at 6-month follow-up						
1. TST	433.66	59.25	-			
2. Bedtime	22.96	1.06	-0.46***	-		
3. CMEP	24.64	4.59	0.16	-0.08	-	
Outcome measures at 12-month follow-up						
1. TST	447.43	67.72	-			
2. Bedtime	22.96	1.06	-0.22**	-		
3. CMEP	24.67	4.96	-0.06	-0.15	-	

Note. *p<.05. **p<.01. ***p<.001. ISI = Insomnia Severity Index. SE = sleep efficiency. SDS = Sheehan Disability Scale. IDS-SR = Inventory of Depressive Symptomatology – Self-Report. GAF = Global Assessment of Functioning. TST = total sleep time. CMEP = Children's Morningness-Eveningness Preference Scale.

Table 2

Demographic Information for Studies 1, 2, and 3

Variables	Mean or N	% or SD
Study 1: Adults with interepisode bipolar disorder and insomnia (N=58)		
Age (years)	36.84	11.69
Female	36	62.07
Race (2 declined to answer)		
American Indian or Alaskan Native	1	1.72
Asian	5	8.62
African-American or Black	7	12.07
Caucasian	37	63.79
Native Hawaiian or Other Pacific Islander	0	0.00
Mixed Race	6	10.34
Ethnicity (1 declined to answer)		
Hispanic or Latino	51	87.93
Not Hispanic or Latino	6	10.34
Study 2: Adults with major depressive disorder (N=48)		
Age (years)	44.27	10.97
Female	29	60.41
Race		
American Indian or Alaskan Native	1	2.08
Asian	4	8.33
African-American or Black	2	4.17
Caucasian	36	75.00
Native Hawaiian or Other Pacific Islander	0	0.00
Mixed Race	1	2.08
Ethnicity (3 declined to answer)		
Hispanic or Latino	8	16.67
Not Hispanic or Latino	37	77.08
Study 3: Adolescents with an evening circadian preference (N=176)		
Age (years)	14.77	1.84
Female	102	65.38
Race		
American Indian or Alaskan Native	0	0.00
Asian	18	10.23
African-American or Black	12	8.22
Caucasian	114	64.77
Native Hawaiian or Other Pacific Islander	2	1.14
Mixed Race	30	17.05
Ethnicity		
Hispanic or Latino	27	15.34
Not Hispanic or Latino	149	84.66

Table 3

Multilevel models for Study 1 examining the relationship between engagement measures and treatment outcome

	Engagement measure effect at baseline				Engagement measure effect on change during the treatment phase				Engagement measure effect on change from baseline through 6-month follow-up			
Measure	*Beta*	*SE*	*p*	*95% CI*	*Beta*	*SE*	*p*	*95% CI*	*Beta*	*SE*	*p*	*95% CI*
Attitudinal Engagement (CEQ)												
ISI	0.15	0.11	.19	-0.07, 0.37	-0.51	0.17	.00**	-0.85, -0.18	-	-	-	-
SE	0.11	0.10	.26	-0.08, 0.30	0.20	0.18	.26	-0.14, 0.55	-	-	-	-
SDS-Mood	-0.14	0.13	.28	-0.39, 0.11	0.10	0.20	.60	-0.29, 0.49	-	-	-	-
SDS-Sleep	-0.14	0.013	.28	-0.39, 0.11	.12	.20	.54	-0.27, 0.51	-	-	-	-
Behavioral Engagement (TARS)												
ISI	-0.14	0.14	.33	-0.41, 0.14	-0.13	0.17	.45	-0.46, 0.21	-0.00	0.18	.99	-0.35, 0.35
SE	0.13	0.15	.36	-0.16, 0.42	-0.01	0.15	.97	-0.30, 0.28	-0.13	0.13	.34	-0.39, 0.13
SDS-Mood	-0.14	0.15	.35	-0.42, 0.15	0.00	0.16	.98	-0.31, 0.32	-0.00	0.16	.99	-0.32, 0.31
SDS-Sleep	-0.20	0.14	.17	-0.48, 0.08	0.06	0.18	.76	-0.30, 0.42	0.27	0.19	.17	-0.12, 0.65

Note. *p<.05. **p<.01. Models include treatment condition as a covariate. CEQ = Credibility Expectancy Questionnaire. TARS = Treatment Adherence Rating Scale. ISI = Insomnia Severity Index. SE = sleep efficiency. SDS-Mood = Sheehan Disability Scale – Mood. SDS-Sleep = Sheehan Disability Scale – Sleep. The CEQ was not administered at 6-month follow-up.

Table 4

Multilevel models for Study 2 examining the relationship between engagement measures and treatment outcome

	Engagement measure effect at baseline				Engagement measure effect on change during the treatment phase				Engagement measure effect on change from baseline through follow-up			
Measure	*Beta*	*SE*	*p*	*95% CI*	*Beta*	*SE*	*p*	*95% CI*	*Beta*	*SE*	*p*	*95% CI*
Attitudinal Engagement (CEQ)												
IDS-SR	0.23	0.13	.08	-0.03, 0.48	-0.60	0.15	.00***	-0.90, -0.30	-0.40	0.16	.01*	-0.70, -0.09
GAF	0.40	0.14	.00**	0.13, 0.67	-0.11	0.18	.53	-0.46, 0.24	-0.04	0.17	.79	-0.37, 0.28
Behavioral Engagement (TARS)												
IDS-SR	-0.20	0.14	.15	-0.47, 0.07	-0.24	0.17	.16	-0.57, 0.09	-0.18	0.17	.28	-0.51, 0.15
GAF	-0.09	0.14	.52	-0.37, 0.18	0.42	0.17	.02*	0.08, 0.76	0.45	0.17	.00**	0.12, 0.80

Note. *p<.05. **p<.01. ***p<.001. Models include treatment condition as a covariate. CEQ = Credibility Expectancy Questionnaire. TARS = Treatment Adherence Rating Scale. IDS-SR = Inventory of Depressive Symptomatology – Self-Report. GAF = Global Assessment of Functioning

Table 5

Multilevel models for Study 3 examining the relationship between engagement measures and treatment outcome

	Engagement measure effect at baseline				Engagement measure effect on change during the treatment phase				Engagement measure effect on change from baseline through 6-month follow-up				Engagement measure effect on change from baseline through 12-month follow-up			
Measure	*Beta*	*SE*	*p*	*95% CI*	*Beta*	*SE*	*p*	*95% CI*	*Beta*	*SE*	*p*	*95% CI*	*Beta*	*SE*	*p*	*95% CI*
Attitudinal Engagement (CEQ)																
TST	0.03	0.08	.70	-0.12, 0.18	0.11	0.10	.27	-0.09, 0.21	0.09	0.11	.41	-0.12, 0.29	0.01	0.10	.94	-0.19, 0.20
Bedtime	-0.11	0.07	.11	-0.25, 0.03	-0.09	0.09	.31	-0.27, 0.08	0.02	0.09	.82	-0.16, 0.20	-0.06	0.09	.48	-0.23, 0.11
CMEP	-0.06	0.07	.38	-0.20, 0.07	0.34	0.09	.00***	0.17, 0.52	0.23	0.08	.01*	0.05, 0.40	0.33	0.10	.00**	0.14, 0.52
Behavioral Engagement (TARS)																
TST	0.02	0.09	.86	-0.16, 0.19	-0.17	0.10	.08	-0.35, 0.02	0.02	0.09	.83	-0.16, 0.21	-0.16	0.09	.08	-0.35, 0.02
Bedtime	0.03	0.09	.77	-0.16, 0.21	0.04	0.09	.69	-0.14, 0.21	0.04	0.09	.62	-0.13, 0.21	0.00	0.09	.96	-0.17, 0.17
CMEP	0.16	0.10	.10	-0.03, 0.34	0.01	0.08	.93	-0.16, 0.17	0.01	0.08	.86	-0.15, 0.18	-0.01	0.08	.90	-0.18, 0.15
Behavioral Engagement (Tardiness)																
TST	0.05	0.08	.51	-0.10, 0.20	-0.00	0.08	.96	-0.17, 0.16	0.14	0.09	.11	-0.03, 0.30	0.03	0.09	.69	-0.14, 0.21
Bedtime	-0.10	0.08	.19	-0.25, 0.05	0.05	0.08	.51	-0.10, 0.21	-0.03	0.08	.70	-0.18, 0.12	0.03	0.08	.69	-0.13, 0.19
CMEP	0.08	0.08	.33	-0.08, 0.23	-0.00	0.07	.97	-0.14, 0.14	0.02	0.07	.77	-0.13, 0.17	0.09	0.08	.26	-0.06, 0.24
Interaction of Attitudinal Engagement (CEQ) and Behavioral Engagement (TARS)																
TST	-0.05	0.09	.62	-0.23, 0.13	-0.08	0.12	.48	-0.31, 0.15	0.04	0.12	.76	-0.20, 0.27	0.10	0.13	.43	-0.15, 0.35
Bedtime	0.07	0.08	.36	-0.08, 0.24	-0.03	0.10	.78	-0.23, 0.17	-0.12	0.10	.25	-0.32, 0.08	-0.18	0.11	.12	-0.40, 0.04
CMEP	-0.06	0.08	.49	-0.21, 0.10	0.04	0.10	.70	-0.14, 0.23	-0.06	0.10	.53	-0.26, 0.13	0.02	0.12	.83	-0.21, 0.26

Note. *p<.05. **p<.01. ***p<.001. Models include treatment condition, text messaging condition, age, sex as covariates. CEQ = Credibility Expectancy Questionnaire. TARS = Treatment Adherence Rating Scale. TST = Total sleep time. CMEP = Children's Morningness-Eveningness Preference Scale.