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Eidelman, Polina

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Social Support and Social Strain in Inter-episode Bipolar Disorder

By

Polina Eidelman

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University of California, Berkeley

Committee in charge:

Professor Allison G. Harvey, Chair
Professor Sheri Johnson
Professor Steven Segal

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Abstract

Social Support and Social Strain in Inter-episode Bipolar Disorder

by

Polina Eidelman

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University of Califronia, Berkeley

Professor Allison G. Harvey, Chair

This study focused on social support and social strain and their cross-sectional associations with instabilities in sleep and social rhythms in inter-episode bipolar disorder (BD). Thirty-eight adults diagnosed with inter-episode BD Type I or II and 38 healthy controls completed measures of social support and social strain. Instabilities in sleep and social rhythms in the BD group were assessed with 28 days of diary and actigraphy. Associations between social support, social strain, and mood symptoms in the BD group were also examined. The BD group reported lower social support and higher social strain than the control group. Additionally, social strain was positively correlated with manic symptoms in the BD group. Furthermore, there was a cross-sectional association between social support and more stable sleep on actigraphy in the BD group, although social support was not correlated with future sleep instability. These results indicate that inter-episode BD is associated with deficient social support and elevated social strain compared to controls. Social strain may be particularly important given its association with manic symptoms. The results also raise the possibility that sleep instability is related to poor social support in BD.

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Introduction

Bipolar Disorder (BD) is a severe, chronic, and impairing psychiatric illness. It has an estimated lifetime prevalence of 3.9% (Kessler et al., 2005) and is ranked in the top 10 leading causes of disability worldwide by the World Health Organization. The inter-episode period of BD is defined by the absence of a clinical mood episode (i.e., no depression, mania or hypomania is present), yet it is marked by depressive and/or manic symptoms more than 50% of the time (e.g., Judd et al., 2002, 2003). The inter-episode period is also characterized by instabilities in sleep (e.g., Harvey, 2008) and social rhythms (e.g., Grandin, Alloy, & Abramson, 2006), which likely increase the risk of relapse (e.g., Ehlers, Frank, & Kupfer, 1988) and contribute to persistent inter-episode symptoms and impairment (e.g., Fagiolini et al., 2005). A number of calls have been made for research that will improve inter-episode quality of life through the identification of clinically-relevant psychosocial factors (e.g., Miklowitz & Johnson, 2006). The present study aims to further elucidate the role of two such factors, social support and social strain, during the inter-episode period of BD with a focus on their cross-sectional association with instabilities in sleep and social rhythms.

Social Support

Social support encompasses psychological and material resources provided by one's social network. Perceived social support (i.e., the subjective quality of social support) has been linked to well-being in healthy and medically ill individuals (e.g., Cohen & Wills, 1985; Uchino, Cacioppo, & Kiecolt-Glaser, 1996) and has been found to be a stronger correlate of well-being than objective measures of support (e.g., the number of support providers; Sarason, Sarason, & Pierce, 1990). Greater perceived social support has also been found to promote recovery and prevent relapse in unipolar depressed individuals (e.g., Moos, Cronkite, & Moos, 1998). Several lines of evidence suggest that social support may impact well-being and illness course in BD. For instance, lower levels of perceived social support have been found to predict depressive relapse (Cohen, Hammen, Henry, & Daley, 2004; Johnson, Winett, Meyer, Greenhouse, & Miller, 1999), while higher levels of social support have been theorized to reduce the risk of relapse, possibly by improving medication adherence (e.g., Kleindienst, Engel, & Greil, 2005).

These findings suggest that social support is an important psychosocial factor in BD. However, to the best of the author's knowledge, only two studies have assessed whether social support is deficient during the inter-episode period of BD, and these studies have yielded inconsistent findings. While one study found a group of inter-episode BD women to have deficient social support compared to control women (Romans & McPherson, 1992), another study found social support in inter-episode BD participants to be equivalent to that of controls (Staner et al., 1997). One possible explanation for this discrepancy is that while the former study used a measure of the perceived adequacy of social support, the latter used a measure that averages the amount of support (emotional, availability, and practical) received from the top five support providers. This second approach may decrease variability in scores. Additionally, by requiring individuals to identify five discrete support providers, this measure may serve more as a measure of objective support (e.g. number of adequate support providers) than perceived support. Given the small number of studies focused on social support in inter-episode BD and their mixed findings, additional research is needed to determine whether perceived social support is deficient during this phase of the illness and whether it is related to inter-episode instabilities in sleep and social rhythms.

Social Strain

Social strain encompasses adverse social experiences (e.g., being criticized, ignored, overburdened) that cause one to experience a negative reaction or concerns about one's relationships (Rook, 1990). Social strain has been found to be associated with depressive symptoms (e.g., Franks et al., 1992) and has been identified as a separate construct from life stress (e.g., Lakey, Tardiff, & Drew, 1994) and social support (e.g., Rook, 1984).

To the best of the author's knowledge, social strain has not yet been investigated in BD. However, several studies have linked perceived criticism - one aspect of social strain - to symptoms in BD. For instance, greater distress generated by perceived criticism from friends/family is associated with an increased risk of depressive symptoms (e.g., Miklowitz et al., 2005). Furthermore, an extensive body of research indicates that expressed emotion (i.e., criticism, hostility, and over-involvement) in a bipolar individual's family is associated with a higher level of manic symptoms (Simoneau, Miklowitz, & Saleem, 1998) and an increased risk of relapse (e.g., O'Connell, Mayo, Flatow, Cuthbertson, & O'Brien, 1991). Assessments of expressed emotion typically rely on observations of family members during the Camberwell Family Interview (Vaughn & Leff, 1976), while measures of perceived criticism assess only one aspect of social strain. Thus, additional research is needed to determine whether social strain (i.e., perceptions of adverse experiences in naturally occurring social interactions) is elevated in inter-episode BD and whether it is related to inter-episode instabilities in sleep and social rhythms.

Social Support, Social Strain, and Inter-episode Instabilities in Sleep and Social Rhythms

As already noted, studies of healthy, medically ill, and unipolar depressed individuals suggest that social support and social strain affect well-being (e.g., Cohen & Wills, 1985; Newsom et al., 2003; Moos, Cronkite, & Moos, 1998). A body of research has also examined the influence of social support and aspects of social strain on BD illness course (e.g., Cohen, Hammen, Henry, & Daley, 2004; Miklowitz et al., 2005). However, the associations between social support, social strain, and the instabilities characteristic of inter-episode BD have yet to be examined. Hence, the present study sought to examine the relationship between social support, social strain, and two factors known to be unstable and problematic in inter-episode period BD: sleep and social rhythms. The rationale for the proposed associations will now be detailed.

Taking sleep first, disturbed sleep is a feature of (hypo)manic and depressive episodes (American Psychiatric Association, 2000) and has been found to be disturbed and variable in inter-episode BD (e.g., Harvey, 2008). There is evidence that inter-episode sleep disturbance and variability are associated with past illness course (Eidelman, Talbot, Gruber, & Harvey, 2010) and are predictive of increased mood symptoms (e.g., Bauer et al., 2006). Troxel, Robles, Hall, and Buysse (2007) have drawn attention to the social context of sleep, proposing a biopsychosocial model whereby poor marital relationships are associated with sleep disruption, while positive relationships are related to better quality sleep. Given these findings, it is reasonable that sleep could also be related to social support and social strain associated with an individual's overall social network.

Turning next to social rhythms, Social Zeitgeber Theory (Ehlers, Frank, & Kupfer, 1988) defines "social rhythms" as regularly occurring activities (e.g., social contact and exercise) that help entrain biological rhythms. There is evidence that social rhythm instability is more common in bipolar individuals than in healthy controls (e.g., Ashman et al., 1999) and that social rhythm disruption may increase the risk of relapse in BD (Grandin, Alloy, & Abramson, 2006). In a discussion of Social Zeitgeber Theory (Ehlers, Frank, & Kupfer, 1988), Frank and Swartz (2004) postulate that higher levels of social support could decrease social rhythm instability and disruption in BD, particularly in the presence of a stressful life event. Aspects of social support

have indeed been found to be related to social rhythm stability in a sample of widowed elderly individuals (Prigerson, Frank, Reynolds, George, & Kupfer, 1993). However, the associations between social support, social strain, and social rhythm stability have yet to be assessed in BD.

Study Aims

This study aimed to further characterize social support and social strain in inter-episode BD. The first aim was to compare social support and social strain in inter-episode BD and control participants. It was hypothesized that *social support* reported by inter-episode BD participants would be *lower* than that reported by healthy controls. Moreover, *social strain* reported by inter-episode BD participants was hypothesized to be *higher* than that reported by controls. The second aim was to assess whether social support and social strain are associated with instabilities in sleep and social rhythms in inter-episode BD. It was hypothesized that higher levels of *social support* would be correlated with *less instability* in sleep and social rhythms. Additionally, higher levels of *social strain* were hypothesized to be associated with *greater instability* in sleep and social rhythms.

Methods

Overview

Thirty-eight individuals diagnosed with inter-episode BD Type I or II and 38 healthy controls were enrolled. All participants completed a baseline visit, where diagnostic measures and measures of manic and depressive symptoms, perceived social support and social strain, and medication use were administered. As inter-episode BD instabilities in sleep and social rhythms were of interest, the BD group subsequently completed 28 days of daily diary assessments to capture information about sleep and social rhythms. Sleep was also assessed with 28 days of actigraphy. All participants in the BD and control groups returned to the laboratory for a second visit 28 days after the baseline visit and were reassessed for symptoms, social support, social strain, and medication use over the preceding month (i.e., the time period during which sleep and social rhythms mood were assessed in the BD group).

Participants

Participants were recruited via online advertisements and flyers posted in the San Francisco Bay Area. Interested individuals completed a preliminary telephone screening interview with trained research assistants. In sum, 432 individuals were screened, 68 chose not to enroll or were unable to be reached subsequently, and 288 fell outside the inclusion criteria (specific details follow). The final sample consisted of 38 individuals in the control group and 38 individuals in the BD group (inter-episode instability data were collected from 36 BD group participants as 2 dropped out following the first visit).

Inclusion criteria for the BD group were as follows: BD Type I ($n = 35$) or Type II ($n = 3$) diagnosis according to the Structured Clinical Interview for DSM-IV-TR (SCID; First, Spitzer, Gibbon, & Williams, 2007) (33 excluded for not meeting SCID criteria for BD Type I or II); inter-episode status throughout the study as defined by the absence of a depressive or (hypo)manic episode according to the SCID, and falling at asymptomatic to mild symptom levels on the Clinician Rated Inventory of Depressive Symptomatology (IDS-C; Rush et al., 1996; score less than 24) and the Young Mania Rating Scale (YMRS; Young, Biggs, Ziegler, & Meyer, 1978; score less than 12) in the month preceding each study visit (14 excluded for not being inter-episode at the baseline visit; 2 excluded at the second visit and re-enrolled once symptoms returned to inter-episode levels); being under psychiatric care (requirement of the ethics

committee; 19 excluded for not being under psychiatric care); no suspected diagnosis of substance or alcohol abuse disorder in the 6 months preceding the baseline visit (26 excluded for suspected substance/alcohol abuse); and no suspected confounding sleep disorder, such as sleep apnea or restless leg syndrome, based on responses to the preliminary telephone interview and to the Duke Structured Interview for Sleep Disorders (DSISD; Edinger et al., 2004) (36 excluded for suspected confounding sleep disorder). Inclusion criteria for the control group were as follows: no lifetime history of any form of Axis I disorder according to the SCID (91 excluded on this basis); and no subjective sleep complaints according to the DSISD (29 excluded on this basis). Additionally, individuals were excluded from either participant group for: history of a major head trauma or severe progressive medical illness (29 excluded on this basis); and having no stable living arrangement (11 excluded on this basis).

Demographic characteristics of the participants were representative of the San Francisco Bay Area (see Table 1). As BD is typically associated with the presence of comorbid psychiatric diagnoses (Kessler et al., 2005), participants in the BD group were not excluded on the basis of comorbid diagnoses other than alcohol or substance abuse disorders. Current comorbidities included panic disorder ($n = 3$), social phobia ($n = 3$), specific phobia ($n = 6$), post traumatic stress disorder ($n = 1$), generalized anxiety disorder ($n = 6$), and eating disorder not otherwise specified (binge eating; $n = 2$). Additionally, because studying a medication-free sample of BD participants for a month-long duration is unfeasible and unrepresentative, participants in the BD group were not required to be medication-free. The majority of the BD group reported taking at least one psychotropic medication ($n = 26$), which included mood stabilizers ($n = 8$), antidepressants ($n = 14$), and antipsychotics ($n = 20$).

Measures

Diagnosis and Symptoms. Psychiatric diagnosis was determined for both groups at the baseline visit using the Structured Clinical Interview for DSM-IV-TR (SCID; First, Spitzer, Gibbon, & Williams, 2007). The Clinician Rated Inventory of Depressive Symptomatology (IDS-C; Rush et al., 1996) and the Young Mania Rating Scale (YMRS; Young, Biggs, Ziegler, & Meyer, 1978) were administered at each study visit to assess, respectively, depressive and manic symptoms in the preceding month. This approach yielded symptom data for the month preceding the baseline visit and for the month during which sleep, social rhythms, and mood were assessed in the BD group. The IDS-C total score is based on 28 items with scores ranging from 0 to 84. Scores less than 24 indicate depressive symptoms are in the asymptomatic to mild range. The IDS-C has good psychometric properties and is widely used in medical and research settings (Rush et al., 1996). The YMRS consists of 11 items with scores ranging from 0 to 60. Scores less than 12 indicate (hypo)manic symptoms are in the asymptomatic to mild range (e.g., Suppes et al., 2005). The YMRS has good inter-rater reliability and predictive validity (Young, Biggs, Ziegler, & Meyer, 1978).

To assess diagnostic inter-rater reliability, independent coders scored a randomly selected sample of SCID ($n = 17$) and IDS-C and YMRS interviews ($n = 42$). Primary diagnoses on the SCID matched those made by the original interviewer in all cases ($k = 1.00$). Inter-rater reliability on the IDS-C ($n = 42$; ICC = 0.90) and YMRS ($n = 42$; ICC = 0.84) was also high.

Social Support. Social support was assessed at each study visit using the Interpersonal Support Evaluation List (ISEL; Cohen & Hoberman, 1983). The ISEL is a 40-item self-report measure rated on a scale ranging from 1 to 4, with higher total scores reflecting greater perceived social support. The ISEL assesses support in four domains: tangible assistance (financial/ tangible support), self-esteem (supportive actions by others that impart the individual with a

sense of being lovable, valuable, and capable), appraisal (presence of others with whom problems can be discussed), and belonging (presence of others with whom one can engage in social activities). The ISEL has good psychometric properties (alpha = 0.86, test-retest reliability = 0.87) (Cohen & Hoberman, 1983) and has been used in studies of BD (e.g., Johnson, Meyer, Winett, & Small, 2001). In the present study, total ISEL score was of interest, and internal consistency for the overall measure was high (alpha = 0.94).

Social Strain. Social strain was assessed using the Inventory of Negative Social Interactions (INSI; Lakey, Tardiff, & Drew, 1994). The INSI is a 40-item self-report measure that assesses various types of adverse social experiences (e.g., being criticized, ignored, and left out). The frequency with which these events have taken place in the preceding month are rated using a 1 to 5 scale with higher total scores corresponding to greater social strain. The INSI is psychometrically sound (alpha = 0.92, test-retest reliability = 0.68; Lakey, Tardiff, & Drew, 1994). High internal consistency was found in the present study (alpha = 0.95).

Sleep. Sleep instability was assessed via subjective (i.e., diary) and objective (i.e., actigraphy) estimates. To gather subjective data, BD group participants reported their bedtime, arising time, and amount of wakefulness over the course of the preceding night on each morning of the daily diary. This information was used to calculate nightly total sleep time in minutes ("TSTdiary"). Subjective sleep estimates are an important indicator of the individual's perceived sleep quality and are part of the gold standard assessment of sleep disorders (Buysse et al., 2006).

To gather an objective estimate of sleep instability, BD group participants wore an actigraphy watch (Mini Mitter AW64 Actiwatch Inc.), which assesses wake/sleep time and activity by continuously measuring movement (sampled in 60 second epochs). Data are stored in the watch's embedded miniaturized piezoelectric acceleration sensor. Respironics Actiware Version 5.5 (Copyright 2004-09, Respironics, Inc.) was used to score the stored data and obtain an objective estimate of nightly total sleep time ("TSTactigraphy") for the 28 days of sleep assessment. Nights when participants indicated removing the watch were excluded from analysis. Sleep assessed via actigraphy is strongly correlated with sleep assessed via polysomnography (e.g., Cole et al., 1992). Actigraphy has been validated in clinical samples (Sadeh, Hauri, Kripke, & Laurie, 1995) and has been used in studies of bipolar individuals (Millar et al., 2004). It is ideal for the naturalistic assessment of sleep instability, as it is non-invasive and capable of storing large amounts of continuously collected data.

Social Rhythms. To assess social rhythms, BD group participants completed the Social Rhythm Metric (SRM; Monk, Kupfer, Frank, & Ritenour, 1990) on the daily diary each evening over the 28 days between the baseline and second study visits. The SRM measures daily activity and social contact. It has been validated in healthy and depressed individuals (Monk, Kupfer, Frank, & Ritenour, 1990) and has been used in studies of BD (e.g., Ashman et al., 1999). The SRM consists of a list of 14 activities that may be completed over the course of a day (e.g., going outside for the first time and having lunch). Each evening, participants indicated the time they completed the activities, if applicable. The SRM algorithm (Monk, Kupfer, Frank, & Ritenour, 1990) was used to calculate weekly SRM scores, which were averaged for the diary month to yield a measure of social rhythm instability over the 28 days of the study. Scores range from 0 to 7, with higher scores indicating greater social rhythm stability.

Medication Status. In order to assess medication regimen adequacy in the BD group, participants reported the names and dosages of their medications and indicated when and how often they had taken these medications in the month preceding the second lab visit (i.e., during the period of sleep and social rhythm assessment). Information gathered through this report was

coded using the Somatotherapy Index (Bauer et al., 1997). This 6-point scale was designed to assess treatment adequacy in mood disorders, with higher scores indicating a stronger medication regimen. The Somatotherapy Index is reliable and has been used in BD samples (e.g., Sajatovic et al., 2006). In addition to the average Somatotherapy Index score obtained over the course of the study, subscales were coded to assess mood stabilizer, antidepressant, and alternative (e.g., lamotrigine) treatment. The antidepressant and alternative treatment subscales were coded on a scale ranging 0 to 4 (low to high level of treatment). The mood stabilizer subscale was rated dichotomously (treatment is absent or present) because blood serum levels for these medications were not available (the Somatotherapy Index requires serum levels to rate mood stabilizer treatment level higher than a 1).

Procedure

Interested individuals responding to recruitment postings completed a preliminary screening interview over the telephone. Callers appearing to be potentially eligible for either the BD or control group were invited to the lab for a baseline visit. At this visit, participants signed informed consent and completed the SCID, DSISD, IDS-C, YMRS, ISEL, INSI, and demographics and medication questionnaires. Next, because the study aimed to assess the cross-sectional association between social support, social strain, and instabilities in sleep and social rhythms in inter-episode BD, eligible bipolar participants were invited to participate in 28 days of diary and actigraphy assessments. They were asked to call the lab each time they completed the morning (sleep) and evening (social rhythms) portions of the diary to ensure timely completion of diary entries. Participants who missed three consecutive calls were contacted by study staff and encouraged to resume calling. An average of 88% participant calls were completed as requested. At the end of the 28 days, all BD and control group participants returned to the lab for a second study visit where the YMRS, IDS-C, ISEL, INSI, and the medication questionnaire were administered.

Data Analysis

Following recent discussions of affective instability indexes (Ebner-Priemer, Eid, Kleindienst, Stabenow, & Trull, 2009), the mean square successive differences (MSSD; von Neumann, Kent, Bellison, & Hart, 1941) of TSTdiary and TSTactigraphy were calculated to reflect sleep instability. The MSSD assesses instability in time series data as defined by variability in amplitude and frequency of changes in scores. It was chosen as the measure of sleep instability based on its past use in experience sampling studies of mood in clinical populations (e.g., Ebner-Priemer & Sawitzki, 2007).

Two BD group participants chose not to continue participating after the first visit. Thus, their data was included only in the social support and social strain group comparisons. Five BD participants were missing more than 20% of their diary or actigraphy data; these missing data were replaced by the group means. One participant in the BD group did not complete the INSI at the second visit; the average INSI score for the overall sample was substituted for this missing value. Additionally, 3 participants in the BD group did not provide medication data; the average and modal responses for the sample were substituted for the missing data. There were no differences in ISEL score, INSI score, or second visit symptoms between participants who were missing data and those who were not. However, participants with missing data had higher IDS-C scores at the first visit (M = 12.60 versus 8.14).

Variable distributions were examined to determine if normality assumptions were met. Distributions of MSSD TSTactigraphy and INSI score at the second visit were positively skewed and leptokurtic. These variables were square root transformed and were subsequently found to be

normally distributed. *T*-tests and chi-square analyses were then used to assess for differences in demographic characteristics and symptoms between the BD and control groups.

A MANOVA was used to address the first and second hypotheses by comparing social support and strain in the BD and control groups. In testing the first and second hypotheses, total ISEL (social support) and INSI (social strain) scores averaged across the two lab visits were used, with the rationale that these capture perceptions of social support and social strain over a longer duration than scores obtained at either single time point.

A series of correlations (6 in total) was used to address the third and fourth hypotheses by measuring cross-sectional associations between social support and social strain, and sleep and social rhythm instabilities in the BD group. In testing the third and fourth hypotheses, total ISEL and INSI scores obtained at the second lab visit were used, with the rationale that these scores reflect social support and social strain perceived over the 28 days of diary and actigraphy assessment. An additional set of correlations was used to assess whether social support and social strain at the first visit were correlated with sleep and social rhythm instability in the subsequent month.

Results

Participant Characteristics

Table 1 presents the demographic characteristics and mood symptom data for the BD and control groups as well as information on illness history, medication status, and sleep and social rhythm instabilities in the BD group. The average Somatotherapy Index score in the BD group was fairly low ($M = 1.61$, $SD = 1.48$), in part because blood serum levels for mood stabilizers were not available in calculating scores. As evident in Table 1, the BD and control groups were matched on all demographic variables (including age, gender, marital status, income, and employment status) other than race. Additionally, while all participants were inter-episode over the course of the study, the BD group had significantly higher levels of depressive and manic symptoms at all study points.

---- Insert Table 1 about here ----

Social Support and Social Strain in the Bipolar and Control Groups

Social support and social strain were not correlated in the overall sample ($r = -0.04$, $n = 76$, $p > 0.10$). A MANOVA was used to assess control versus BD group differences in social support (average ISEL score over the course of the study) and social strain (average INSI score over the course of the study). As the BD group had a significantly greater proportion of White participants than the control group, race was included as a covariate in the analysis. A significant omnibus group effect was present in the MANOVA ($F (1, 73) = 12.86$, $p < 0.001$). As evident in Table 2, the BD group had lower social support and higher social strain compared to the control group after accounting for group differences in proportion of White participants.

---- Insert Table 2 about here ----

In the initial analysis, symptoms were not included as covariates, following the argument put forth by Miller and Chapman (2001).[1] The analysis was repeated to explore the potential role

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[1] Miller and Chapman (2001) argue against statistically controlling for symptoms in psychopathology research where group status (e.g., BD versus control) cannot be randomly assigned. Depressive and hypomanic symptoms are a core feature of the inter-episode period of BD (e.g., Fava, 1999). Thus, statistically controlling for them is likely to remove meaningful variance and potentially obscure key group differences (Miller & Chapman, 2001).

of manic and depressive symptoms. A MANOVA using group as a fixed factor and race as a covariate with the additional inclusion of average YMRS and IDS-C score as covariates was used. In this analysis, there was no longer a significant omnibus effect for group (F (2, 70) = 0.85, $p > 0.10$).

Correlations of symptoms (averaged over the first and second visit) with social support and social strain (averaged over the first and second visit) were examined in the BD group. Average social strain over the course of the study period was associated with average manic symptoms over the study period ($r = 0.36$, $n = 38$, $p < 0.05$) but not with average depressive symptoms ($r = 0.26$, $n = 38$, $p > 0.10$). Social support was not correlated with manic or depressive symptoms ($p's > 0.10$). The potential temporal associations between social strain and symptoms in the BD group were further assessed with two regression analyses. A model using social strain at the first visit as a predictor of manic symptoms at the second visit after controlling for manic symptoms at the first visit was not significant ($F(2, 31) = 3.79$, $p>0.05$; $R^2 = 0.15$). A model using manic symptoms at the first visit as a predictor of social strain at the second visit after controlling for social strain at the first visit was significant ($F(2, 31) = 11.28$, $p<0.001$; $R^2 = 0.42$). However, manic symptoms at the first visit did not account for a significant proportion of the explained variance in the model (ß=0.14, $t = 1.69$, $p > 0.10$).

Social Support, Social Strain, and Inter-episode Instabilities in the BD group

Before testing hypotheses related to inter-episode instabilities in the BD group, demographics, medication status, illness history, and symptom levels in the inter-episode BD group were examined to assess whether they represented potential confounding variables. No variable was found to be associated with both a dependent and an independent variable of interest. Thus, none of the examined variables was believed to be a confound, and no covariates were included in the analyses.[2]

To test the hypothesis that social support would be cross-sectionally correlated with instabilities in sleep (MSSD of TSTdiary and MSSD of TSTactigraphy) and social rhythms (SRM score), a set of 3 correlations were used. There was a significant correlation between ISEL score at the second visit and MSSD of TSTactigraphy ($r = -0.36$, $n = 36$, $p <0.05$), indicating that higher levels of social support were associated with more stable sleep as assessed via

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[2] Specifically, among the demographic variables, being an ethnic/racial minority ($t(34) = 2.27$, $p < 0.05$) and being unemployed/on disability ($t(36) = -2.03$, $p = 0.05$) were associated with lower social support. Age was not significantly correlated with ISEL score ($r = 0.02$), INSI score ($r = -0.18$), MSSD of TSTdiary ($r = -0.09$), MSSD of TSTactigraphy ($r = -0.18$), or SRM score ($r = 0.09$). Among the illness history variables examined, age at illness onset was not significantly correlated with ISEL score ($r = 0.04$), INSI score ($r = -0.12$), MSSD of TSTdiary ($r = 0.20$), MSSD of TSTactigraphy ($r = 0.04$), or SRM score ($r = -0.01$). There was a trend for history of psychosis to be associated with decreased social support ($t (31) = 1.97$, $p < 0.10$). Of medication status variables examined, average somatotherapy score was not significantly correlated with ISEL score ($r = -0.03$), INSI score ($r = 0.10$), MSSD of TSTdiary ($r = -0.18$), MSSD of TSTactigraphy ($r = -0.22$), or SRM score ($r = 0.22$). The antidepressant and mood stabilizer subscales were also not significantly correlated with the variables of interest. The number of alternative treatments was positively correlated with SRM score ($r = 0.58$, $p < 0.001$), and there was a trend for it to be negatively correlated with MSSD of TSTactigraphy ($r = -0.30$, $p < 0.10$). However, it was not correlated with ISEL ($r = 0.11$) or INSI scores ($r = 0.05$). Among the symptom variables examined, there was a trend for YMRS score at the second visit to be correlated with social strain over the course of the preceding month ($r = 0.31$, $n = 36$, $p < 0.10$). YMRS score at the second visit was not correlated with ISEL score ($r = 0.16$), MSSD of TSTdiary ($r = 0.12$), MSSD of TSTactigraphy ($r = -0.00$), or SRM score ($r = -0.24$). IDS-C score at the second visit was not correlated with ISEL score ($r = 0.01$), INSI score ($r = 0.18$), MSSD of TSTdiary ($r = -0.03$), MSSD of TSTactigraphy ($r = -0.04$), or SRM score ($r = -0.15$).

actigraphy. There were no other significant findings, as social support was not related to MSSD of TSTdiary ($r = -0.06$) or SRM score ($r = -0.02$).

To test the hypothesis that social strain would be cross-sectionally correlated with instability in sleep and social rhythms, an additional 3 correlations were used. There were no significant findings, as social strain was not correlated with MSSD of TSTdiary ($r = 0.17$), MSSD of TSTactigraphy ($r = -0.11$), or SRM score ($r = -0.10$).

In order to explore possible temporal associations between social support, social strain, and inter-episode instabilities, correlations between social support and social strain at the first visit and instabilities in the subsequent month were assessed. There were no significant findings.

Discussion

The overarching goal of the present study was to further characterize social support and social strain in inter-episode BD. The first aim was to compare social support and social strain in inter-episode BD and control participants. The results supported the hypothesis that inter-episode BD would be associated with lower social support compared to controls. This is consistent with past findings of deficient social support in a sample of women diagnosed as inter-episode BD Type I (Romans & McPherson, 1992). The present study replicated and extended these findings to a diverse sample of inter-episode BD men and women. Recall that Staner and colleagues (1997) did not find BD to be associated with deficient social support. This likely relates to differences in measures. The present study and Romans and McPherson (1992) both emphasized *perceived* social support, while the measure used by Staner and colleagues (1997) is somewhat more consistent with an *objective* (i.e., quantitative) social support measure. In sum, as in unipolar depression (e.g., George, Blazer, Hughes, & Fowler, 1989), it appears that the *perceived* quality of social relationships is lacking in men and women with inter-episode BD rather than the number of available support providers.

The hypothesis that inter-episode BD would be associated with a higher level of social strain compared to the control group was also supported. To the best of the author's knowledge, this is the first study that has assessed social strain in BD. Interestingly, social strain in the BD group was positively correlated with manic symptoms, while social support was not correlated with symptoms. Analyses examining the prospective association between social strain and manic symptoms indicate that strain does not predict manic symptoms after controlling for baseline manic symptoms, and that manic symptoms do not predict social strain after controlling for baseline social strain. This suggests that manic symptoms and social strain may be related in a bidirectional manner, such that more symptomatic individuals perceive a higher level of social strain, while social strain exacerbates manic symptoms. Furthermore, it is possible that individuals who are more symptomatic generate more strain in their relationships (e.g., Hammen, 1991). The possibility of a bidirectional association between social strain and manic symptoms suggested by the present findings is consistent with the finding that bipolar individuals whose families are characterized by more expressed emotion experience more manic symptoms (Simoneau, Miklowitz, & Saleem, 1998). This suggests that attending to social strain in future studies of social relationships in BD may be particularly important, as social support in BD has previously been found to protect against depressive but not manic relapse (e.g., Johnson et al., 1999). The present findings raise the possibility that social strain may ultimately prove to be a stronger correlate of manic symptoms than social support.

It is noteworthy that group was not a significant predictor of social support and social strain once symptom levels were entered as covariates. This suggests that inter-episode symptoms may account for the lower levels of social support and higher levels of social strain found in the BD group compared to the control group. As symptoms are a core feature of the inter-episode period of BD (e.g., Fava, 1999), it is not surprising that they would account for a significant portion of the variance initially explained by the BD diagnosis. Indeed, perhaps it is not the BD diagnosis itself but rather persistent inter-episode symptoms (e.g., Judd et al., 2002, 2003) that are associated with the deficient social support and increased social strain reported by bipolar individuals. These results are consistent with previous findings of wide-spread impairment in inter-episode BD (e.g., Fagiolini et al., 2005) and suggest that inter-episode symptoms are significantly related to social support and social strain in this illness.

The second aim was to assess whether social support and social strain in inter-episode BD are associated with instabilities in sleep and social rhythms. In support of the hypotheses, results indicated that greater social support was cross-sectionally associated with more stable sleep as assessed with actigraphy. This is consistent with, and expands on, the biopsychosocial model of sleep (Troxel, Robles, Hall, & Buysse, 2007), which states that better quality sleep is associated with better quality relationships. Interestingly, although support and sleep instability were correlated in cross-sectional analyses, social support at the first visit was not correlated with sleep instability in the subsequent month. This may be due to the fact that it was not possible to control for sleep instability present at the time of the first social support assessment. Nevertheless, the findings suggest that social support may not independently predict future sleep instability in BD. Instead, it may be the case that social support and sleep instability are related in a bidirectional manner or that sleep instability contributes to decreased social support. This is an important issue for future research as the present study design did not allowed us to examine whether sleep instability predicted social support, thereby precluding conclusions regarding causality. It should be noted that the cross-sectional association between social support and sleep instability in this study was found for actigraphy but not diary. This is not surprising, as discrepancies between subjective and objective estimates of sleep have previously been reported across a range of disorders (e.g., Harvey & Tang, Submitted). Discrepancies between subjective and objective sleep estimates may be due to the fact that sleep onset and duration are difficult to perceive and remember accurately (e.g., Bonnet, 1990). Additionally, subjective and objective measures may reflect different aspects of sleep disturbance, such that stability in the amount of sleep obtained is associated with social support but one's perceptions of sleep stability is not.

It was also hypothesized that social support and social strain in the inter-episode BD group would be associated with instabilities in social rhythms. These hypotheses were not supported. There are a number of possible explanations. First, the hypotheses were based on Social Zeitgeber Theory (Ehlers, Frank, & Kupfer, 1988; Frank & Swartz, 2004), which proposes that social support helps to stabilize social rhythms in BD. However, the theory specifically focuses on this stabilizing effect in the context of life stress, which was not measured in the present study. Second, social support and social strain may not be directly related to social rhythm stability because regular and stable occurrences in an individual's life may involve adverse social experiences (e.g., dinner may occur nightly at 7 PM, but it may also involve family members criticizing the bipolar individual). Thus, assessing the quality of the specific activities comprising one's social rhythms may be a useful next step in elucidating whether support and strain have a stabilizing/destabilizing effect on these rhythms in inter-episode BD.

A number of potential limitations of the present study must be noted. First, the sample size was relatively small, thereby limiting power to detect significant effects. Specifically, the analyses focused on instabilities in the BD group were somewhat under-powered, as power was sufficient to detect only relatively large effect sizes ($r = 0.23$ or higher). The study's focus on inter-episode BD also resulted in a restricted range in symptom measures. Thus, a larger sample may have led to more findings reaching statistical significance, particularly in analyses concerned with symptoms in the BD group. Second, no correction was made for multiple comparisons, which increases the risk of Type I error. However, decreasing the risk of Type II error (Nakagawa, 2004) was a concern as associations between social support/strain and inter-episode BD instabilities have not been previously examined. Consequently, we chose not to correct for multiple comparisons in order to maximize information gleaned from this initial study. Third, the BD and control groups were not matched on ethnic/racial composition. Although group differences in support and strain remained after controlling for this, it will be important for the study results to be replicated in ethnically matched samples. Fourth, this study was a first step toward investigating potential associations between social support, social strain, and inter-episode instabilities in BD. The use of prospective longitudinal designs in future studies is needed to more thoroughly examine temporal associations between support/strain and BD symptoms and instabilities. Fifth, participants recorded information about their daily social rhythms each evening, so the data may have been subject to recall bias (Bower, 1981). Although timely response and call-in rate were excellent (88% on average) it may be helpful to use hand-held data logging devices in future studies. Sixth, the measure used to assess medication adequacy is a self-report measure. The accuracy of medication data would be enhanced with the use of blood serum level testing and/or checking medications with prescribing physicians in future studies. Furthermore, although there are possible confounding effects of psychotropic medications on sleep, it is noted that no measure of medication status was associated with sleep instability variables.

In conclusion, the results indicate that social support and social strain represent clinically relevant psychosocial factors that significantly impact the lives of individuals with inter-episode BD. Specifically, the present study expanded on past work to suggest that social support is deficient in inter-episode BD men and women of diverse backgrounds. Additionally, social strain was found to be elevated and significantly correlated with inter-episode manic symptoms in the BD group, suggesting that it may play a particularly important role in BD that is separate from that played by social support. Furthermore, the association between social support and sleep instability in the inter-episode BD group suggests that social support may help to stabilize key biological rhythms in this population. Given the potential theoretical and clinical implications of these findings, incorporating measures of social support and social strain in longitudinal studies of BD is an important goal for future research focused on this chronic and impairing disorder.

Table 1. Demographics, Illness History, Medication Status, Mood Symptoms, and Inter-episode Instability in Bipolar (BD) and Control Groups

	Control ($n = 38$) M (SD)	BD ($n = 38$) M (SD)	χ^2 or t
Demographics			
Age (in years)	32.85 (12.91)	33.97 (10.28)	-0.43
Gender (% Female)	51.3%	56.4%	0.32
Marital Status			0.19
% Single	56.4%	69.2%	
% Married/Live in partner	35.9%	7.7%	
% Divorced/Separated/Widowed	7.7%	23.1%	
Race (% White)	35.9%	66.7%	6.29*
Income (% <$50,000)	64.1%	71.8%	0.53
Employed (%)	76.9%	61.5%	2.16
Illness History			
BD Type (% Type I)	---	91.7%	---
Age at illness onset (years)	---	17.65 (6.71)	---
Total past manic episodes	---	7.57 (14.78)	---
Total past depressive episodes	---	8.88 (11.56)	---
History of psychiatric hospitalization	---	55.6%	---
Number of psychiatric hospitalizations	---	1.75 (2.96)	---
History of psychosis	---	45.7%	---
Medication Status at Second Visit			
Somatotherapy Score	---	1.61 (1.48)	---
Antidepressant treatment level	---	1.27 (1.61)	---
Alternative treatment level	---	0.36 (0.49)	---
Mood stabilizer treatment present	---	27.3%	---
Mood Symptoms at Baseline and Second Visits			
YMRS Baseline Visit	0.92(1.36)	3.40 (3.10)	-4.52*
IDS-C Baseline Visit	2.30 (2.09)	8.55 (4.46)	-7.76*
YMRS Second Visit	1.11 (1.56)	4.07 (3.93)	-4.26*
IDS-C Second Visit	3.16 (3.03)	11.24 (5.58)	-7.74*
Average YMRS	1.03 (1.23)	3.54 (2.64)	-5.39*
Average IDS-C	2.74 (2.26)	9.81 (3.90)	-9.79*
Inter-episode Instability Variables			
MSSD of TSTdiary (in minutes)	---	16847.13 (8600.53)	---
MSSD of TSTactigraphy (in minutes)	---	13388.25 (8864.95)	---
SRM average score	---	2.76 (0.72)	---
MSSD of Positive Affect (PA)	---	55.13 (41.33)	---
MSSD of Negative Affect (NA)	---	46.60 (31.31)	---

Note: * $p \leq 0.05$. YMRS = Young Mania Rating Scale; IDS-C = Clinician Rated Inventory of Depressive Symptomatology; SRM = Social Rhythm Metric; MSSD = Mean Square Successive Difference; TSTdiary = Total Sleep Time on diary in minutes; TSTactigraphy = Total Sleep Time on actigraphy in minutes.

Table 2. Social Support and Social Strain in the BD and Control Groups after Controlling for Race

	BD (n = 38) Est. Marginal Mean (Std. Error)	Control (n = 38) Est. Marginal Mean (Std. Error)	F
Social Support (ISEL)	89.28 (2.31)	98.87 (2.31)	8.28*
Social Strain (INSI)	19.98 (1.88)	9.76 (1.88)	14.09**

Note: * $p \leq 0.005$; ** $p \leq 0.001$. ISEL = Interpersonal Support Evaluation List (average score over first and second visit); INSI = Inventory of Negative Social Interactions (average score over first and second visit).

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