The Use of Diary Methods to Evaluate Daily Experiences in First-Episode Psychosis

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Abstract

Experience sampling methods have been used to study symptomatology and functioning in schizophrenia and first-episode psychosis (FEP). However, few studies have used daily diaries to measure experiences such as mood and social functioning in FEP. We sought to first identify predictors of daily diary compliance in a sample of 38 individuals with FEP. Second, we assessed the relationship between daily diary ratings and clinician-administered assessments at mid-treatment and post-treatment. Finally, we evaluated the effect of I-CAT, a mindfulness and positive therapy-based intervention, on daily diary ratings of happiness, sadness, stress, relaxation, adaptation, and social interactions compared to Treatment as Usual (TAU). We found no significant predictors of daily diary compliance, though participants with higher completion rates had higher average social functioning scores. The diary was significantly related to clinician-administered assessments at mid-treatment on domains of happiness, sadness, stress, and relaxation. Finally, ICAT did not have a significant impact on daily diary ratings relative to TAU.

The Use of Diary Methods to Evaluate Daily Experiences in First-Episode Psychosis

In the past thirty years, a growing body of psychological research has used daily diary methodology (Gunthert & Wenze, 2012). Advancements in technology have made diary-based data collection easier and more reliable, contributing to the popularity of such methods. Daily diary studies encompass a wide range of designs, including time-based (fixed-interval or variable-interval) and event-contingent protocols (Bolger et al., 2003). Experience sampling and ecological momentary assessments are also considered forms of diary methodology (Larson & Csikszentimihalyi, 1983). Additionally, diary studies vary in duration of participation, frequency of data collection, and complexity of responses depending on the purpose of the research (Iida et al., 2012). Electronic response formats were first used in the late 1990s (Stone et al., 1998) and have since grown to be the predominant form of diary collection. Participants typically access a secure website and complete their responses online; this protocol also allows data to be easily stored and retrieved for analysis (Iida et al., 2012).

Diary methods confer a number of advantages to researchers. Data are collected within participants' natural context, increasing the ecological validity of the results (Lischetzke, 2014). Additionally, the frequent nature of the assessments reduces retrospective bias that can influence participants' aggregate memories of a past time period (Iida et al., 2012; Schwarz, 2012). Evidence suggests that when the interval of time between an experience itself and the recall of that experience is increased, participants rely more upon semantic memory and their generalized beliefs rather than episodic memory of that specific event (Robinson & Clore, 2002). Such retrospective reports are thus prone to cognitive biases, personality influences, and stereotyped beliefs (Robinson & Clore, 2002). For example, McAuliffe et al. (2007) found that individuals substantially underreported sexual behavior in retrospective reports when compared to daily

diary accounts, suggesting that diary methods may yield more valid data. Additionally, evidence suggests that diary methods are less likely to lead to reactivity—an advantage over other methods of survey research (Gleason et al., 2003; Hufford et al., 2002; Litt et al., 1998).

Despite these benefits, diary protocols are limited by participant tolerance. Broderick and colleagues (2003) found that after requiring participants to complete diary entries three times per day, compliance fell significantly after only one week, and that frequency of data collection may affect compliance. Numerous psychological studies have investigated the specific factors which determine whether a participant completes diary entries. Telzer and Fuligni (2009) found that in a sample of 563 high-school students, baseline demographic and academic variables predicted participation in the diary study. Similarly, in a study of youth with bipolar disorder, baseline clinical variables functioned as predictors of diary completion—more lifetime suicide attempts, and elevated symptom severity predicted significantly less compliance (Gershon et al., 2019).

Researchers have also used diary methods to investigate the relationship between daily reports and retrospective assessments in various domains of psychology, which holds relevance for clinical evaluation and treatment. A study of Dutch adolescents found low concordance between daily and retrospective reports of victimization, echoing previous findings that adolescents may over-report victimization when assessed retrospectively due to memory and reputational biases (Nishina and Juvonen, 2005; Pouwels et al., 2016). Mill et al. (2016) found that personality traits moderate the relationship between ecological momentary assessments of emotions and retrospective ratings, including associations between neuroticism and elevated retrospective reports of sadness and anger. These findings support the idea that personal and trait characteristics influence the accuracy of retrospective self-reports. Furthermore, Campbell and colleagues (2017) found that among adults with post-traumatic stress disorder, there was

variation in the concordance between daily and retrospective reports on the basis of symptom stability and alcohol consumption. This suggests that clinical and behavioral characteristics may further influence retrospective reporting, which is important given that such reports are commonly used to assess symptoms and functioning.

Within schizophrenia research, several studies have established that diary methods are a feasible and acceptable data collection method (Edwards et al., 2016; Granholm et al., 2008). However, Vachon et al. (2019) found in a meta-analysis that individuals with psychosis were less compliant than non-psychotic participants. There is also some evidence that cognitive impairment and symptom severity may broadly predict non-compliance (Buck et al., 2020; Granholm et al., 2008). Other studies have found no relationship between baseline clinical features and diary completion, resulting in an incomplete understanding of the role of symptom severity in compliance (Hartley et al., 2014).

Several studies have used diary methods to investigate the relationship between daily and retrospective reports in schizophrenia. Granholm et al. (2020) found that ecological momentary assessments of social interactions and functioning behaviors were not strongly related to in-lab assessments of functional capacity or the ability to complete tasks without assistance. Granholm et al. propose that this could be the result of retrospective biases or discrepancies in what the two methods actually measure. Kupper and Tschacher (2008) examined the relationship between retrospective subjective improvement scores and symptom changes as measured by a daily survey. They found no significant relationships, suggesting that retrospective subjective assessments may not parallel daily symptom progress (Kupper and Tschacher, 2008).

While the utility of diary methods in chronic schizophrenia has been well-established, there is a paucity of research involving daily diaries in first-episode psychosis. Because the

disease trajectory is most plastic during early phases, first-episode psychosis (FEP) is a key target for psychosocial intervention (Birchwood & Jackson, 1998). Daily diaries offer an opportunity to measure psychological processes in terms of daily functioning, beyond the walls of the clinic, and over a longer period of time than other methods. While several studies have used experience sampling methods to establish temporal patterns in FEP (Gerritsen et al., 2019, Klippel et al., 2017, Reininghaus et al., 2016), daily diary studies are the exception to the rule in this population. Therefore, it is important to assess the utility of daily diaries as outcome measures in first-episode patients.

The present study is a secondary data analysis of daily diary data collected from 38 participants with first-episode psychosis enrolled in the Integrated Coping Awareness Therapy (I-CAT) trial over a nine-month period. The I-CAT trial evaluated the effects of both positive psychotherapy and mindfulness, each of which are associated with reduced stress and strengthened coping abilities, in participants with first-episode psychosis (Khoury et al., 2013; Schrank et al., 2016). This honors thesis has the following aims. First, we sought to characterize daily diary compliance in order to determine if baseline clinical or demographic features are associated with diary completion in a population with first-episode psychosis. Second, we conducted an exploratory evaluation of the relationship between daily diary reports of mood, social interactions, and anxiety and corresponding retrospective primary and secondary outcomes. Finally, we assessed the impact of treatment on daily diary scores from the I-CAT trial. We hypothesize that participants in the I-CAT condition will demonstrate decreased stress, increased positive mood, and increased social interactions relative to those who received Treatment as Usual (TAU).

Methods

Participants

Participants for this study (UNC IRB #20-3208) were drawn from the larger I-CAT

randomized treatment study (UNC IRB #16-1173) that was conducted from November 2016 to

March 2020. All participants were in the early stages of schizophrenia spectrum disorder and met

diagnostic criteria for schizophrenia or schizoaffective disorder as determined by the DSM-IV

(American Psychological Association, 2013). Participants were between 18 and 35 years of age,

clinically stable, and had no hospitalizations in the prior three months. Participants were

excluded if they reported actively practicing meditation prior to the study. The final sample of 38

participants was 53% male (n = 20) and 47% female (n = 18), with 66% of participants

identifying as White, 18% as Black, 11% as Asian, and 5% as American Indian/Alaskan Native

(Table 1). The average duration of illness was 1.74 years (SD = 1.73), and 68% of participants

were employed or students (Table 1).

Individuals were recruited from community clinics at two sites: The University of North

Carolina at Chapel Hill (n = 35), and the University of Minnesota—Twin Cities (n = 3).

Participants completed a screening visit to ensure they met inclusion criteria and completed

assessments with research staff at baseline, mid-treatment (4.5 months), post-treatment (9

months), and follow up (3 months after post-treatment). Participants were randomized to I-CAT

(n = 19) or TAU (n = 19).

Integrated Coping Awareness Therapy

The I-CAT intervention is designed to target stress responses in first-episode psychosis

using mindfulness and positive psychotherapy, with an emphasis on goal setting, practicing

skills, and homework assignments. The I-CAT intervention was divided into three parts: Part I

focused on education on mindfulness and stress reactivity. Part II integrated mindfulness practice and the development of coping strategies. Mindfulness homework included sitting meditation, body scans, and walking meditations; coping strategies included identifying personal strengths and setting positive goals. Part III involved the creation of an individualized plan for achieving meaningful personal goals and implementing the skills developed in Part II. All therapy sessions were recorded and rated for fidelity to ensure that the content of I-CAT and TAU sessions did not extensively overlap (Halverson et al., under review).

Treatment as Usual

Participants randomized to TAU participated in traditional therapy sessions on a weekly or bi-weekly basis. Therapists working with participants in TAU were instructed not to include elements of the I-CAT intervention, such as meditation or formal mindfulness. In order to ensure that TAU did not overlap with I-CAT to a significant degree, all sessions were recorded and rated for fidelity.

Study Therapists

Therapists were composed of full-time masters level clinicians ($n = 2$) and doctoral students ($n = 10$). Therapists attended a workshop on I-CAT principles including positive psychology, goal setting, and mindfulness theories over the course of two days prior to the study (Halverson et al., under review).

The Daily Diary

All participants completed a daily diary beginning with their first therapy session. The diary was electronic and accessible via a smartphone or laptop and was password-protected. All diary mood items were answered using a 1-7 Likert Scale, with higher scores indicating greater intensity. Additionally, each participant was asked to record the number of in-person and digital

social interactions they had experienced that day by entering a numerical answer (see Appendix A).

The daily diary scores for sadness were monitored each day by an undergraduate research assistant. Participants with sadness scores above six for more than two days in a row were identified to the participant's study clinician to ensure safety. Reminders were sent via text or e-mail to participants who missed more than two days of diary entries in a row. Participants received $1 per diary entry, with the possibility of receiving up to $196.

Measures

Primary Outcome Measures from the RCT

Positive and negative emotions. The modified self-report Differential Emotion Scale (mDES; Fredrickson et al., 2003) is a self-rated assessment of 20 emotions experienced over the prior week on a five-point scale (0 = not experienced at all; 4 = experienced most of the time). Responses to these questions are summed to produce a positive and a negative emotion subscale ranging from 0-40 with higher scores indicating greater frequency of experiencing positive and negative emotions respectively.

Stress. The Perceived Stress Scale (PSS; Cohen et al., 1983) is a 10-item self-report measure used to assess the frequency of situations perceived as stressful or uncontrollable during the past month. Items are rated on a 5-point Likert scale and summed for a total score (0-40) with higher scores indicating greater perceived stress.

The Clinician-Reported Stress Scale was also used by the participant's therapist to assess individual stress in a single-item seven-point scale (with 1 being not at all stressed and 7 being very stressed).

The Daily Stress Inventory (DSI; Brantley et al., 1987) is a 58-item self-report measure used to assess the frequency and impact of stressful events that have occurred within the past 24-hours. If an event occurred, participants rate the event on a scale of 1-7, with lower scores indicating less stress and higher scores indicating intense stress. Scores are summed to yield a total (0-406) with higher scores indicating greater stress.

Role-Functioning. The abbreviated Quality of Life Scale (QLS; Bilker et al., 2003) is a 7-item, semi-structured interview assessing personal functioning. Each item is rated on a six-point scale resulting in a total score (0-42) with higher total scores indicating better functioning. Total score was used for this analysis.

The First Episode Social Functioning Scale (FESFS; Lecomte et al., 2014) is a 42-item self-report measure with eight domains: living skills, interacting with people, friends and activities, intimacy, family, relationships at work, work abilities, and relationships at school. Each domain is averaged (range 0-4), with higher scores representing better functioning. The total score is the average of the eight domain scores, with higher total scores representing better functioning.

Secondary Outcome Measures from the RCT

Symptoms. The Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987) is a semi-structured interview that assesses symptom severity over the past week. Items are rated on a 7-point scale and summed for a total score (30-210) with higher scores reflecting more severe symptoms. Items are also averaged according to a five-factor structure (Wallwork et al., 2012) resulting in five subscales: positive, negative, depressive, excited, and disorganized symptoms. Each scale ranges from 1-7, with higher scores representing greater severity.

Mindfulness. The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) is a 39-item measure that assesses mindfulness in five areas: acting with awareness, observing, describing, non-reactivity to inner experience, and non-judging of inner experience. Each item is rated on a scale of 1 to 5 (1 = never or rarely true; 5 = very often or always true). Responses are summed for a total score (39-195), with higher scores representing greater mindfulness.

The Self-Compassion Scale Short Form (SCS-SF: Raes et al., 2011) is a 12-item measure of self-compassion. Items are rated on a 5-point scale (1 = almost never; 5 = almost always). Scores are summed for an overall total score (12-60), with higher scores indicating greater self-compassion.

Well-being. The Psychological Well-Being Scale (PWB; Ryff, 1989) is a 54-item measure assessing well-being. Each item is rated on a six-point scale, and items are summed for a total score (54-324), with higher scores indicating greater well-being.

The GRIT Scale (Duckworth et al., 2007) is a 12-item survey that assesses perseverance and resilience. Statements are endorsed on a 5-point scale and responses are averaged to achieve a total score ranging from 1-5, with 5 indicating extremely "gritty" and 1 indicating not at all "gritty."

Data Analytic Plan

All analyses were completed using an IBM SPSS subscription (2020). For the first aim, we identified clinical and demographic variables that have been related to experience sampling completion or treatment compliance in previous research, and used a series of bivariate regressions to determine if these variables functioned as predictors of completion rate. To further explore predictors of compliance, participants were dichotomized as compliant or non-compliant based on a 70% completion benchmark at post-treatment. This benchmark was

selected based on the distribution of completion rates across all participants (see Appendix B). Completion rates were based on the total number of diary entries per individual divided by the total diary period for that person (from the first therapy session through the post-treatment appointment date). Independent samples t-tests were used to evaluate baseline group differences on primary and secondary outcome assessments, and Chi-Square analyses were used to evaluate group differences among categorical variables such as gender and race.

In the second aim, we explored the relationship between diary ratings and retrospective self-reports using a Pearson's *r* partial correlation analysis. Diary ratings for each mood domain were averaged across two weeks prior to each assessment point (mid-treatment and post-treatment). These average diary scores were then compared to related assessments as follows: diary happiness ratings to the positive subscale of the mDES; diary sadness ratings to the negative subscale of the mDES; diary stress and relaxation ratings to the PSS; and diary social interactions to the QLS[1]. Treatment condition was included as a variable in partial correlations in order to control for the effects of intervention type. In order to be included in this analysis, participants must have attended the mid-treatment or post-treatment assessment, and must have had at least 1 diary entry in the 2-week period preceding the assessment date.

Finally, in the third aim, we compared composite diary scores from the I-CAT and TAU groups to determine whether these scores differ significantly on the basis of treatment condition at mid-treatment and post-treatment. This was accomplished using a series of independent samples *t*-tests to compare mean diary scores between groups. Additionally, multiple regression was used to control for the effects of baseline diary scores.

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[1] Diary adaptation scores were not used in this analysis because there were no clinical measures directly related to adaptation.

Results

Aim 1—Completion of the Diary

Baseline participant demographics are presented in Table 1 for the entire sample and as a function of treatment group. As a first step, we identified clinical and demographic variables that have been related to experience sampling completion or treatment compliance in previous research, and used a series of bivariate regressions to determine if these variables functioned as predictors of completion rate. These variables included gender and overall symptoms as measured by the PANSS (Vachon et al., 2019), as well as depressive symptoms (Kampman and Lehtinen, 1999; Pan and Tatam, 1989). To tap into depressive type symptoms, we included the anhedonia and motivation questions from the QLS and the negative subscale of the mDES. Finally, we included a meaure of social functioning, the FESFS, given its importance in FEP. Bivariate regressions revealed no significant relationships between these variables and completion rate (see Table 2).

Because of the distribution of the diary data (see Appendix B), participants were dichotomized into those who completed the diary more than 70% of the period ($n = 14$) and those who completed it less than 70% of the period ($n = 18$). Six participants were excluded from this analysis because they did not attend a post-treatment visit and no completion rate could be calculated. The remaining participants ($n = 32$) had a mean completion rate of 52.4% over an average eight month period in the study. Participants in the greater than 70% completion group averaged 82.0 entries ($SD = 9.84$), and participants in the less than 70% completion group averaged 29.4 entries ($SD = 17.6$).

The results of *t*-tests and chi-square analyses are presented in Table 3. Scores on the FESFS (social functioning scale) were significantly different—participants with greater than

70% completion rates had higher average social functioning scores, $t(30) = 2.07$, $p < 0.05$. There were no other significant differences between the two groups on any clinical or demographic features.

Aim 2—Relationship to Clinical Variables

Pearson's *r* partial correlations were used to determine the relationship between diary ratings and clinical assessments at mid-treatment ($n = 26$) and post-treatment ($n = 19$). At mid-treatment, eight participants were excluded because they failed to attend the mid-treatment assessment, and an additional four participants were excluded because they had no diary entries in the prior two weeks. At post-treatment, six participants were excluded due to missed assessments, and an additional thirteen were excluded because they had no diary entries in the prior two weeks.

Mean scores on each diary and clinical measure are presented in Table 4. The results of the partial correlation analyses showed that higher diary ratings of happiness were significantly associated with higher ratings on the mDES positive subscale at both mid-treatment and post-treatment (Table 5). Additionally, higher diary sadness ratings were associated with higher scores on the mDES negative subscale, and higher diary stress ratings were associated with elevated scores on the PSS at mid-treatment. Increased diary relaxation was inversely related to PSS scores at mid-treatment. These relationships were not statistically significant at post-treatment. There were no significant relationships between diary social interactions questions and either QLS question at any time point. These findings remained the same after controlling for treatment condition (see Table 5).

Aim 3—Diary Data as an Outcome Measure

In this aim, independent-samples *t*-tests were conducted at mid-treatment (*n* = 26) and at post-treatment (*n* = 19) to determine the effect of treatment condition on daily diary ratings. For this aim, baseline was operationalized as the first two weeks of diary entries for all participants (*n* = 38).

There were no significant differences between I-CAT and TAU on baseline daily diary ratings of happiness, sadness, stress, relaxation, adaptation, or social interactions. Additionally, there were no significant differences at mid-treatment on the basis of treatment condition on diary ratings of happiness, sadness, stress, relaxation, adaptation, or social interactions (Table 6). Therse results were unchanged after controlling for baseline daily diary ratings.

At post-treatment, stress was significantly higher in the I-CAT group (*t*(17) = 2.33, *p* = 0.03), but this finding was no longer significant after controlling for baseline stress (*B* = 1.18, *t*(16) = 2.10, *p* = 0.05).

Discussion

This study evaluated three aims relating to the use of daily diaries in first-episode psychosis. First, we sought to identify clinical and demographic predictors of diary completion rate in order to understand which participants are more likely to engage with a daily diary task. Second, we conducted analyses examining the relationships between daily diary reports of mood and social interactions and corresponding retrospective clinical assessments. Finally, Aim 3 evaluated the effect of the I-CAT intervention on daily diary reports.

Aim 1 Discussion

The primary bivariate regression analyses for Aim #1 revealed no demographic or clinical predictors of daily diary completion rate. These findings are consistent with past research

that found no demographic or clinical predictors of compliance in experience sampling studies (Hartley et al., 2014). Given that inclusion criteria for the I-CAT study included no recent hospitalizations and that 89.5% of participants were on medication, it is possible that there was not sufficient variability in symptoms to observe an impact of daily diary compliance. This is supported by the fact that participants were only moderately symptomatic at baseline (Halverson et al., under review). These sample characteristics may explain why our findings differ from other previous studies that have identified psychosis and depressive symptoms as factors in compliance (Kampman and Lehtinen, 1999; Pan and Tatam, 1989; Vachon et al., 2019).

The exploratory t-tests in Aim 1 were generally consistent with the regression analyses with the exception being that participants with greater than 70% completion demonstrated significantly higher social functioning scores on the FESFS than participants with less than a 70% completion rate. Participants with better functioning may have felt more connected to study coordinators/therapists and may have had a stronger understanding of their social role as a participant in a research trial. Additionally, participants with better functioning may be more likely to have daily routines or feel more comfortable completing the diary, which would be seen by the research assistant.

Aim 2 Discussion

For Aim 2, we found that daily diary ratings of happiness and sadness were significantly associated with retrospective clinical ratings on the mDES positive and negative emotions subscales at mid-treatment. Additionally, diary ratings of stress and relaxation were significantly associated with retrospective stress ratings on the PSS at mid-treatment. These findings confirm that there are significant relationships between the Likert-scale diary questions and retrospective clinical assessments on domains of of happiness, sadness, stress and relaxation. Thus, diary

reports may provide valuable information to clinicians about daily mood and stress with a diminished likelihood of retrospective bias.

At post-treatment, only the relationship between happiness and the mDES positive subscale remained significant. The associations between diary and retrospective measures of sadness, stress, and relaxation were similar in direction to those seen at mid-treatment, but were not high enough to be statistically significant. There were no significant demographic or clinical differences between the participants present only at mid-treatment and the participants present at both mid-treatment and posttreatment. Therefore, it is unlikely that these results are due to differences in sample characteristics at mid-treatment and postreatment. Thus, we hypothesize that the post-treatment findings may reflect the decreased statistical power due to fewer participants.

The diary recordings of social interactions, both in-person and digital, were not related to the Quality of Life Scale (QLS) at either time point. It is possible that the daily diary and QLS ratings of social functioning actually measure different constructs: the daily diary asks about the number of interactions while the QLS asks more nuanced questions about aquaintances and social interactions. For example, the QLS Social Initiatives section asks whether participants reach out to people first or wait to be approached, or whether the participant has usually done things alone or with other people (Appendix C). This seems qualitatively different than reporting on number of interactions. Additionally, the two selected QLS questions (Active Aquaintances and Social Initiatives) do not inquire about social media use, which is included in the daily diary.

Aim 3 Discussion

Overall, the hypothesis that ICAT would have a differential impact on daily diary ratings at mid-treatment and post-treatment was not supported. With regards to diary measures of

happiness and sadness, the quality of supportive/non-specific therapy given to TAU participants may have made it difficult to determine differences between I-CAT and TAU. Specifically, there were no significant differences between I-CAT and TAU on client-rated, therapist-rated, or observer-rated thearapeutic alliance, indicating similar therapist-client relationships across both conditions (Orleans-Pobee et al., unpublished manuscript). Additionally, most participants at UNC Chapel Hill were recruited from clinics specializing in early intervention services, which have been shown to be highly effective forms of therapy (Correll et al., 2018). Therefore, constructs such as happiness and sadness could have been comparably addressed in both I-CAT and TAU.

The null findings in regard to stress are consistent with results from the I-CAT randomized controlled trial (RCT), which found that I-CAT did not demonstrate reductions in stress relative to TAU on clinical assessments (Halverson et al., under review). In addition, ICAT did not impact adaption to change on the daily diary. This is somewhat inconsistent with the findings from the RCT, as ICAT was associated with higher mindfulness than TAU (Halverson et al. under review). It is possible that the question "How well did you adapt to change today" from the daily diary is not strongly representative of participants' overall feelings of mindfulness and coping abilities.

Finally, there were no differences between I-CAT and TAU on diary ratings of social interactions at any time point. This is inconsistent with the results of the RCT, which found that I-CAT exhibited stronger school relationships at post-treatment. It is possible that the number of social interactions a participant logs each day may not reflect their true social functioning or satisfaction. As demonstrated in Aim 2, the diary numerical logs of social interactions did not correlate with scores on the QLS. Therefore, these null findings suggest that number of social

interactions may not be reflective of overall social functioning. This suggests that the quality, rather than quantity, of social interactions might be a more valid reflection of social functioning for individuals with FEP.

Limitations

The first limitation was a small sample size, which was especially pronounced for Aims 2 and 3 at post-treatment. This may have been the result of a long study period, with an average of eight months of involvement for each participant. Compensation only extended to the first 196 days of the diary period, which may have contributed to a decline in entries over time.

A second limitation is related to baseline data. For Aim 2, participants completed baseline clinical assessments several weeks before the start of therapy sessions (and thus the start of the diary period). As a result, the first diary entries could not be compared to baseline clinical assessments to establish initial relationships between the diary and clinical measures. In Aim 3, the diary baseline was operationalized as each individiual's first two weeks of entries. However some participants started the diary on the day of their first therapy session and others several days later. As a result, some participants may have begun practicing I-CAT homework such as mindfulness or meditation during the baseline period, introducing treatment effects.

Finally, it is important to note that the daily diary was often completed at the end of each participants' day and thus may have some retrospective bias when compared to experience sampling methods that collect momentary data.

In conclusion, the daily diary shows promise for use as a measure of functioning outside of the clinical setting for individuals with FEP, particularly on items such as happiness, sadness, stress, and relaxation. Future work should continue to investigate clinical and demographic

factors that may strengthen or weaken the relationship between daily diary and retrospective

reports.

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Tables and Figures

Table 1

Baseline Demographic Characteristics

	I-CAT	TAU	*p* value	Total
	n = 19	*n* = 19		*N* = 38
Age, years - mean ± SD	23.6 ± 4.31	24.9 ± 3.86	0.33	24.2 ± 4.09
Male % (n)	53 (10)	53 (10)	0.99	53 (20)
Education, years - mean ± SD	13.8 ± 1.93	14.2 ± 1.92	0.56	14.0 ± 1.91
Race % (n)				
White	57.9 (11)	73.7 (14)	0.31	65.8 (25)
Black	26.3 (5)	1.4 (2)	0.21	18.4 (7)
Asian	1.5 (2)	1.5 (2)	0.19	10.5 (4)
American Indian/Alaskan Native	5.3 (1)	5.3 (1)	0.99	5.3 (2)
Ethnicity % (n)				
Hispanic/Latino	21.1 (4)	5.3 (1)	0.15	13.2 (5)
Duration of Illness, years - mean ± SD	1.68 ± 1.46	1.79 ± 2.0	0.85	1.74 ± 1.73
Employed/Student % (n)	84.2 (16)	52.6 (10)	0.04*	68.4 (26)

Table 2

Results of Bivariate Regressions Examining Empirical Predictors of Completion Rate (Aim 1)

Variable	B	SE	*p* value
PANSS[a]			
Positive	-0.99	5.33	0.85
Negative	-5.71	5.31	0.29
Disorganized	-11.58	7.54	0.14
Excited	-7.66	14.90	0.61
Depressed	1.01	5.38	0.85
QLS[b]			
Anhedonia Question	1.10	3.65	0.77
Motivation Question	1.12	3.24	0.74
mDES[c]			
Negative Subscale	0.26	0.57	0.65
FESFS[d]	17.18	12.49	0.18
Gender	2.14	10.88	0.85
Treatment Condition	-12.40	10.65	0.25

[a] Positive and Negative Syndrome Scale (Kay et al., 1987)
[b] Quality of Life Scale (Bilker et al., 2003)
[c] modified Differential Emotion Scale (Fredrickson et al., 2003)
[d] First Episode Social Functioning Scale (Lecomte et al., 2014)

Table 3

T-Test and Chi-Square Analysis of Baseline Demographic and Clinical Features (Aim 1)

	Participants Over 70% Completion n = 14		Participants Under 70% Completion n = 18		t	χ2	p value	Effect Size[1]
	Mean	**SD**	**Mean**	**SD**				
Age (years)	24.4	3.25	24.4	4.79	-0.03	-	0.97	-0.01
Education (years)	14.5	1.87	14.1	1.83	0.68	-	0.51	0.24
Employment (weekly hours)	25.9	10.2	19.4	15.8	1.13	-	0.27	0.50
Illness duration (years)	1.57	1.14	1.80	2.19	-0.40	-	0.67	-0.13
Perceived Stress Scale[a]	21.9	7.31	21.6	5.99	0.12	-	0.91	0.05
WASI IQ Score[b]	113.3	12.3	107.7	13.3	1.21	-	0.23	0.43
Clinician Rated Stress Score[c]	4.80	0.79	4.67	0.78	0.40	-	0.70	0.17
Quality of Life Scale[d]	27.7	8.76	24.6	7.62	1.09	-	0.28	0.38
Daily Stress Inventory (Sum)[e]	48.4	39.6	52.6	38.4	-0.30	-	0.77	-0.11
FFMQ[f]	123.1	13.2	114	16.2	1.71	-	0.10	0.61
mDES[g]								
Positive Subscale	15.5	10.9	11.9	6.6	1.14	-	0.26	0.41
Negative Subscale	10.4	11.8	8.28	7.85	0.62	-	0.54	0.22
Psychological Well Being Scale[h]	235	29.6	238.5	14.4	-0.44	-	0.66	-0.16
Self-Compassion Scale[i]	35.6	9.02	35.8	8.18	-0.04	-	0.97	-0.02
GRIT Scale[j]	3.01	0.61	3.13	0.66	-0.50	-	0.62	-0.18
FESFS[k]	3.27	0.39	2.97	0.42	2.07	-	0.05*	0.74
PANSS[l]								
Total	57.7	19.1	62.8	16.1	-0.81	-	0.42	-0.29
Positive	2.25	0.88	2.31	1.17	-0.19	-	0.85	-0.07
Negative	1.93	1.24	2.19	0.83	-0.70	-	0.49	-0.25
Disorganized	1.67	0.68	2.07	0.69	-1.67	-	0.12	-0.59
Excited	1.16	0.23	1.26	0.45	-0.78	-	0.44	-0.28
Depressed	3.33	0.99	3.07	1.06	0.70	-	0.49	0.25
Gender - %, *n*								
Male	50	7	44	8	-	0.10	0.76	0.06
Female	50	7	56	10				
Race - %, *n*								
White	64.3	9	66.7	12	-	2.64	0.45	0.29
Black	28.6	4	11.1	2				
Asian	7.1	1	16.7	3				

American Indian/ Alaskan Native	0	0	5.6	1				
Treatment Condition - %, n								
ICAT	50	7	55.6	10	-	0.10	0.76	0.06
TAU	50	7	44.4	8				

[1] Cohen's d for T-tests; Cramer's V for Chi-Square Analyses
[a] range 0-40 (Cohen et al., 1983)
[b] Wechsler, 1999
[c] range 1-7
[d] range 0-42 (Bilker et al., 2003)
[e] range 0-406 (Brantley et al., 1987)
[f] Five Facet Mindfulness Questionnaire; range 0-4 (Lecomte et al., 2014)
[g] modified Differential Emotion Scale; range 0-40 (Fredrickson et al., 2003)
[h] total score; range 54-324 (Ryff, 1989)
[i] range 12-60 (Raes et al., 2011)
[j] range 1-5 (Duckworth et al., 2007)
[k] First Episode Social Functioning Scale; range 0-4 (Lecomte et al., 2014)
[l] Positive and Negative Syndrome Scale; total range 30-210; subscale range 1-7 (Kay et al., 1987)

Table 4

Mean Diary and Clinical Scores at Mid-Treatment and Post-Treatment (Aim 2)

	Mid-Treatment *n* = 26		Post-Treatment *n* = 19	
	Mean	SD	Mean	SD
Number of Diary Entries	9.04	4.53	8.89	4.14
Happiness[a]				
Diary Happiness Score	4.65	1.27	5.02	1.20
mDES Positive Subscale	18.19	12.52	17.89	12.21
Sadness[b]				
Diary Sadness Score	2.55	1.28	2.38	1.02
mDES Negative Subscale	7.31	7.67	5.26	5.43
Stress[c]				
Diary Stress Score	2.90	1.20	3.15	1.43
Diary Relaxation Score	4.49	1.08	4.89	1.23
PSS	19.10	7.59	19.58	5.81
Social Interactions[d]				
Diary In-Person Interactions	4.51	1.48	4.83	1.84
Diary Digital Interactions	2.53	2.30	3.35	2.11
QLS Active Aquaintances	3.42	1.84	3.84	1.83
QLS Social Initiatives	3.62	1.75	3.95	1.54

[a] Diary happiness (1-7) and mDES Positive Subscale (0-40); (Fredrickson et al., 2003)
[b] Diary sadness (1-7) and mDES Negative Subscale (0-40); (Fredrickson et al., 2003)
[c] Diary stress and relaxation (1-7) and Perceived Stress Scale (0-40); (Cohen et al., 1983)
[d] Diary in-person and digital interactions (free-entry) and items from the QLS Scale (0-7) (Bilker et al., 2003).

Table 5

Pearson's r Correlation Between Diary Ratings and Clinical Measures (Aim 2)

	Mid-treatment $n = 26$		Post-Treatment $n = 19$	
	r	p value	r	p value
Happiness[a]				
Uncontrolled[1]	0.49	0.01*	0.49	0.03*
Controlled for Treatment	0.52	0.01*	0.50	0.03*
Sadness[b]				
Uncontrolled	0.62	<0.001*	0.42	0.08
Controlled for Treatment	0.64	<0.001*	0.43	0.07
Stress[c]				
Uncontrolled	0.48	0.02*	0.43	0.06
Controlled for Treatment	0.49	0.02*	0.33	0.19
Relaxation[d]				
Uncontrolled	-0.51	0.01*	-0.36	0.13
Controlled for Treatment	-0.54	0.01*	-0.32	0.20
Social Interactions (In-Person)[e]				
Uncontrolled QLS 1	0.33	0.10	0.27	0.26
Controlled for Treatment	0.31	0.13	0.31	0.23
Uncontrolled QLS 2	0.34	0.09	0.28	0.24
Controlled for Treatment	0.32	0.12	0.27	0.28
Social Interactions (Digital)[f]				
Uncontrolled QLS 1	0.03	0.88	0.19	0.45
Controlled for Treatment	0.02	0.94	0.18	0.48
Uncontrolled QLS 2	0.16	0.44	0.26	0.29
Controlled for Treatment	0.15	0.48	0.27	0.28

[1] Uncontrolled values include the effects of treatment condition; controlled values represent the correlation when treatment effects are excluded.
[a]Diary happiness (1-7) and mDES Positive Subscale (0-40); (Fredrickson et al., 2003)
[b]Diary sadness (1-7) and mDES Negative Subscale (0-40); (Fredrickson et al., 2003)
[c]Diary stress (1-7) and Perceived Stress Scale (0-40); (Cohen et al., 1983)
[d]Diary relaxation (1-7) and Perceived Stress Scale (0-40); (Cohen et al., 1983)
[e]Diary social interactions in person and QLS 1 (Active Acquaintances; 0-7) and QLS 2 (Social Initiatives; 0-7) (Bilker et al., 2003).
[f]Diary social interactions digital and QLS 1 (Active Acquaintances; 0-7) and QLS 2 (Social Initiatives; 0-7) (Bilker et al., 2003).

Table 6

Results of Independent Samples T-Tests Comparing I-CAT and TAU Diary Scores (Aim 3)

|		**I-CAT**		**TAU**				
		Mean	SD	Mean	SD	*t*	*p* value	Cohen's d
		n = 19		*n* = 19				
Diary Baseline *n = 38*	Happiness	4.39	0.89	4.67	1.07	-0.88	0.39	-0.29
	Sadness	2.56	0.92	2.81	1.18	-0.74	0.47	-0.24
	Stress	3.31	1.06	3.10	1.12	0.58	0.56	0.19
	Relaxation	3.86	0.91	4.17	1.13	-0.92	0.36	-0.30
	Adaptation	4.29	0.94	4.77	1.41	-1.25	0.22	-0.40
	Social Interactions 1	4.10	1.67	3.71	1.41	0.78	0.44	0.25
	Social Interactions 2	2.47	1.80	2.44	1.71	0.06	0.96	0.02
		n = 15		*n* = 11				
Mid-treatment *n = 26*	Happiness	4.49	1.28	4.87	1.28	-0.75	0.46	-0.30
	Sadness	2.64	1.24	2.44	1.39	0.38	0.70	0.15
	Stress	2.99	0.97	2.66	1.36	0.71	0.48	0.28
	Relaxation	4.38	1.04	4.60	1.19	-0.49	0.63	-0.19
	Adaptation	5.01	1.24	4.83	1.50	0.34	0.74	0.14
	Social Interactions 1	4.30	1.56	4.80	1.38	-0.85	0.40	-0.34
	Social Interactions 2	2.37	1.96	2.75	2.77	-0.41	0.69	-0.16
		n = 10		*n* = 9				
Post-Treatment *n = 19*	Happiness	4.94	1.07	5.11	1.39	-0.30	0.77	-0.14
	Sadness	2.49	0.9	2.26	1.18	0.47	0.65	0.22
	Stress	3.80	1.33	2.43	1.22	2.33	0.03*	1.07
	Relaxation	4.64	0.98	5.16	1.46	-0.93	0.37	-0.43
	Adaptation	4.82	1.25	5.84	1.29	-1.75	0.10	-0.81
	Social Interactions 1	4.41	1.82	5.30	1.85	-1.06	0.31	-0.49
	Social Interactions 2	3.55	1.93	3.11	2.38	0.44	0.67	0.20

Note: Participants averaged a similar number of entries at baseline (*M* = 8.55, *SD* = 4.79), mid-treatment (*M* = 9.04, *SD* = 4.53) and post-treatment (*M* = 8.89, *SD* = 4.14).

Appendix A

I-CAT DIARY

.. DAYS COMPLETED ...... LOG OUT

Daily diary for today:
Thursday-7/23/2020

1. YOUR FEELINGS

Overall, how Happy were you today?
? ? ?

Overall, how Sad were you today?
? ? ?

Overall, how Stressed were you today?
? ? ?

Overall, how Relaxed were you today?
? ? ?

How well did you adapt to change today?
? ? ?

2. CONTACT WITH OTHER PEOPLE

About how many interactions (face to face or over the phone) did you have today with people outside of your family?
? ? ?

About how many times today did you initiate contact with someone outside of your family via text, or social media (e.g., Facebook, Instagram)?

For all participants, the diary consisted of the following mood questions: "Overall, how happy were you today?; Overall, how sad were you today? Overall, how stressed were you today? Overall, how relaxed were you today? and How well did you adapt to change today?" All items were answered using a 1-7 Likert Scale, with higher scores indicating greater intensity. Additionally, each participant was asked to record the number of in-person and digital social interactions they had experienced that day by entering a numerical answer.

Appendix B
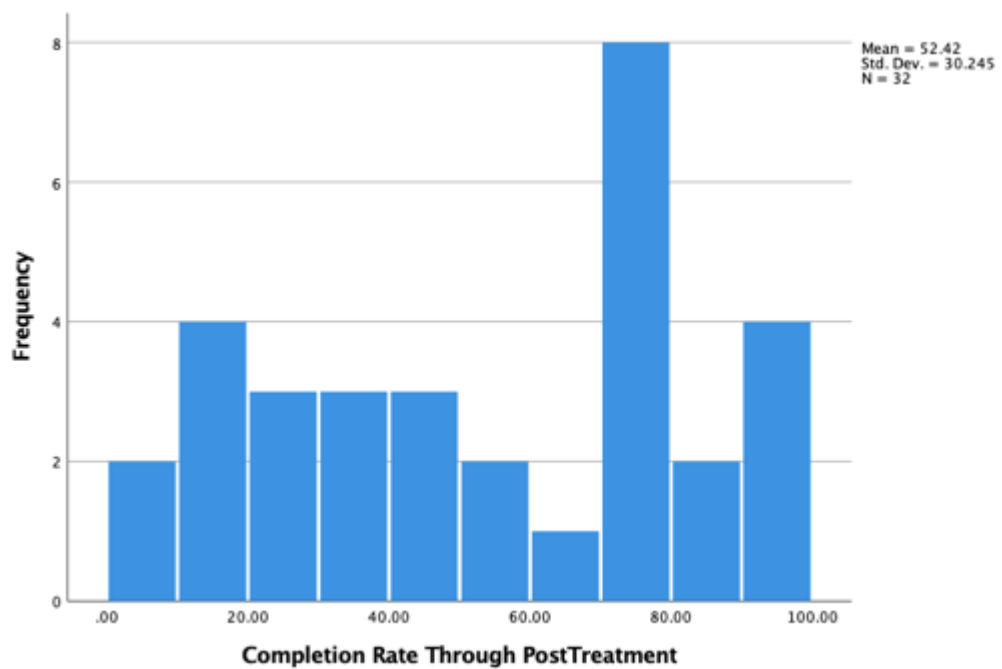
Appendix C

Quality of Life Scale (QLS)
Patient Questionnaire

Abbreviated version (based on Bilker et al. 2003)

Interviewer Instructions: Please circle the response that best describes the overall functioning in each area. Answer this questions based on the responses the patient gives you for each of the prompt questions during this interview.

1. **RATE ACTIVE ACQUAINTANCES**
   This item rates the patient's relationships with people based on liking one another and sharing common activities or interests, but without the intimate emotional investment of the previous item. Exclude relationships with mental health workers and other household members.

   Questions:
   a. **Apart from close personal friends, are there people you know with whom you have enjoyed doing things?**
   b. **How many?**
   c. **How often have you gotten together?**
   d. **What things have you done together?**
   e. **Have you been with people as a part of clubs or organized activities?**
   f. **Have you had extra social contact with co-workers, such as going to lunch together or going out after work?**

RATING

0	1	2	3	4	5	6
Virtually absent		Few active acquaintances and only infrequent contact		Some ongoing active acquaintances, but reduced contact and limited shared activity		Adequate involvement with active acquaintances

COMMENTS:

2. RATE SOCIAL INITIATIVES
This item rates the degree to which the patient is active in directing his/her social interactions - what, how much, and with whom.

Questions:
a. Have you often asked people to do something with you, or have you usually waited for them to ask you?
b. When you have had an idea for a good time, have you sometimes missed out because it's hard for you to ask others to participate?
c. Have you contacted people by phone?
d. Have you tended to seek people out?
e. Have you usually done things alone or with other people?

RATING

0	1	2	3	4	5	6
Social activity almost completely dependent on others		Occasional social initiative, but social life significantly impoverished due to his/her pattern of social passivity, or initiative limited to immediate family		Evidence of some reduction of social life, but only with minimal adverse consequences on his/her social activity		Adequate social initiative

COMMENTS: