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Emotion Regulation Predicts Everyday Emotion Experience and Social Function in Schizophrenia

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Abstract

While recent evidence has pointed to disturbances in emotion regulation strategy use in schizophrenia, few studies have examined how these regulation strategies relate to emotionality and social behavior in daily life. Using ecological momentary assessment (EMA), we investigated the relationship between emotion regulation, emotional experience, and social interaction in the daily lives of individuals with schizophrenia. Participants (N = 30) used mobile phones to complete online questionnaires reporting their daily emotional experience and social interaction. Participants also completed self-report measures of habitual emotion regulation. Hierarchical linear modeling revealed that self-reported use of cognitive reappraisal and savoring of emotional experiences were related to greater positive emotion in daily life. In contrast, self-reported suppression was related to greater negative emotion, reduced positive emotion, and reduced social interaction in daily life. These findings suggest that individual differences in habitual emotion regulation strategy usage have important relationships to everyday emotional and social experiences in schizophrenia.

Keywords

emotion regulation, schizophrenia, social functioning, ecological momentary assessment, emotion

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Emotion regulation refers to the process by which we implement strategies in an attempt to influence emotional responses (e.g., Gross, 1998). Attempting not to scowl when feeling angry (suppression), viewing a frigid day as a chance to relax inside (cognitive reappraisal), and savoring a moment spent laughing with friends (savoring)—these are all ways that we go about regulating our emotional responses. Over the past decade, emotion regulation has been the topic of much research, identifying commonly used regulatory strategies along with the important correlates and consequences of utilizing these strategies. For example, regulating one's emotions does not just impact how a person feels but also relates to social connectedness (Lopes, Salovey, Côté, Beers, & Petty, 2005). Further, research suggests that understanding emotion regulation may have important implications for understanding and treating mental illness (e.g., Aldao, Nolen-Hoeksema, & Schweizer, 2010; Kring & Sloan, 2009). Individuals with schizophrenia experience impairments in emotion regulation strategy use, including a greater use of emotional suppression (e.g., Horan, Hajcak, Wynn, & Green, 2013), a strategy often associated with less positive emotional function. However, few studies have examined the functional relevance of such impairments by examining how these emotion regulation strategies are related to emotionality and social behavior in everyday life. Moreover, to our knowledge, no study to date has investigated the relationship between trait-level emotion regulation and how it relates to emotional and social functioning in the daily lives of people with schizophrenia utilizing ecologically valid methods of assessment. The goal of the current study was to use

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ecological momentary assessment (EMA) to investigate the relationship between emotion regulation, emotional experience, and social interaction outside of the laboratory and in the daily lives of individuals with schizophrenia.

One regulation strategy generally thought to be adaptive is cognitive reappraisal, defined as the attempt to alter the way one thinks about an event in order to alter its emotional impact (Gross, 1998). Individual difference studies of emotion regulation suggest that the habitual use of cognitive reappraisal to help manage negative emotional experiences has been linked to greater positive emotion, less negative emotion, and overall feelings of well-being in healthy controls (e.g., Gross & John, 2003; Haga, Kraft, & Corby, 2009; John & Gross, 2004). Habitual suppression is another commonly studied regulation strategy, defined as an attempt to diminish the expression of emotional responses (Gross, 1998). Habitual use of suppression has been linked to greater negative emotion, less positive emotion, and poorer interpersonal functioning in healthy controls (e.g., Butler et al., 2003; Gross, 2002). However, research also suggests that suppression may at times be adaptive, with the degree of adaptiveness varying both by culture and situation (e.g., Bonanno, Papa, Lalande, Westphal, & Coifman, 2004; Butler, Lee, & Gross, 2007). While the bulk of research on emotion regulation has focused on reappraisal and suppression, there are a number of additional ways in which we can regulate our emotional experience. One such way is the savoring of positive emotion, defined as a focus and attention to the present feelings of positive emotion (Bryant, 2003). Attending to current positive experiences has been linked to increased positive emotion, increased well-being, and greater social functioning in healthy participants (e.g., Fredrickson, 1998; Quoidbach, Berry, Hansenne, & Mikolajczak, 2010).

Studies investigating emotion regulation in schizophrenia have been mixed. Some studies have shown that individuals with schizophrenia do not differ from controls in their self-reported habitual use of reappraisal and suppression (Badcock, Paulik, & Mayberry, 2011; Henry et al., 2007; Henry, Rendell, Green, McDonald, & O'Donnell, 2008; Perry, Henry, & Grisham, 2011; Perry, Henry, Nangle, & Grisham, 2012). However, other studies have found that participants with schizophrenia reported using suppression more often than control participants (Horan et al., 2013; Kimhy et al., 2012; Livingstone, Harper, & Gillanders, 2009; van der Meer, van't Wout, & Aleman, 2009). Further, Kimhy and colleagues (2012) found that lower suppression and higher reappraisal were associated with better social functioning in schizophrenia. Perry and colleagues (2011) showed a similar pattern wherein the habitual use of suppression was related to poorer social functioning, while reappraisal was related to decreased levels of depression and negative symptoms. While relatively little is known about savoring of positive emotion in schizophrenia, positive emotion has been linked to greater social functioning (Blanchard, Mueser, & Bellack, 1998), suggesting a similar relationship as seen in healthy controls. Thus, while the evidence is mixed on whether individuals with schizophrenia differ in their self-reported habitual use of specific emotion regulation strategies, evidence does suggest that the use of these strategies has important relationships to social functioning and emotional well-being.

Work has also been done to investigate whether individuals with schizophrenia are able to effectively implement emotion regulation strategies in laboratory-based settings. Perry and colleagues (2012) asked individuals with schizophrenia and healthy controls to watch sad video clips and implement various emotion regulation strategies. They found no group differences in the ability to implement the regulation conditions and showed that both controls and those with schizophrenia reported a reduction in sadness experienced following reappraisal strategy. This suggests an ability to regulate emotions, at least sadness, upon instruction in schizophrenia. In contrast, others have found that people with schizophrenia may show impairments implementing regulation strategies. Strauss and colleagues (2013) examined the late positive potential response (LPP), an event-related potential thought to index emotional responsivity that is often reduced to negative stimuli following instructions to regulate emotional responses. They found that individuals with schizophrenia did not show a reduction in the LPP when viewing negative images following negative descriptors versus following neutral descriptors designed to induce a reappraisal of the image. Horan and colleagues (2013) found converging evidence for disrupted LPPs during emotion regulation in schizophrenia. However, Strauss et al. (2013) found that schizophrenia participants and controls both showed a reduction in self-reported negative emotional experience following the neutral descriptors, suggesting a possible dissociation between the neural response and emotion experience. Taken together, these findings suggest that while modulation of neural responses during emotion regulation may be impaired, there is evidence that people with schizophrenia may be able to modulate their emotional experience following explicit instruction to utilize emotion regulation strategies.

While previous laboratory findings have begun to shed light on the habitual use of emotion regulation in schizophrenia and their correlates to emotional well-being, a crucial next step is to examine how these

regulation strategies relate to the emotional and social functioning in the daily lives of those with schizophrenia. Toward this end, the goal of the current study was to examine the relationships between self-reported habitual emotion regulation strategies, emotional experience, and social functioning using a method of assessment that captures people as they go about their daily lives. We took an EMA approach to allow for the assessment of emotional experience and social interaction outside of the laboratory and in daily life. This method allows for a more naturalistic approach to data collection and allows for multiple repeated assessments over time to gain a better understanding of experiences as they occur naturally during everyday life (e.g., Ben-Zeev, McHugo, Xie, Dobbins, & Young, 2012). Our aim was to test the hypothesis that habitual emotion suppression would be related to greater negative emotion, decreased positive emotion, and decreased social functioning and social engagement in daily life. In contrast, we hypothesized that cognitive reappraisal and savoring would be related to greater positive emotion, reduced negative emotion, and greater social engagement in daily life.

Methods

Participants

Thirty-four individuals meeting *Diagnostic and Statistical Manual of Mental Disorders* (4th edition, text rev.; *DSM–IV–TR*; American Psychiatric Association, 2000) criteria for schizophrenia ($n = 27$) or schizoaffective disorder ($n = 7$) participated in this study. Exclusion criteria included (a) *DSM–IV–TR* diagnosis of substance abuse or dependence in the past 6 months, (b) *DSM–IV–TR* diagnosis of a current mood disorder, (c) changes in medication 2 weeks prior to consent, (d) IQ less than 70 as measured by the Wechsler Test of Adult Reading (WTAR; Wechsler, 2001), and (e) history of severe head trauma and/or loss of consciousness. All participants were stable outpatients who had not changed medications 2 weeks prior to study participation. Diagnoses were confirmed using the Structured Clinical Interview for *DSM–IV* Axis I disorders. Psychotic symptoms were assessed using the Brief Psychiatric Rating Scale (BPRS; Overall & Gorham, 1962). Negative symptoms were assessed using the Clinical Assessment Interview for Negative Symptoms (CAINS; Kring, Gur, Blanchard, Horan, & Reise, 2013). The CAINS consists of a motivation and pleasure scale (MAP) and an expression subscale (EXP). Higher CAINS scores relates to greater pathology. All participants provided written informed consent to the protocol approved by the Washington University Institutional Review Board. Participant demographics are presented in Table 1. Thirty-two participants were taking an antipsychotic at the time of study participation, while two participants were medication free for at least 1 month prior to study participation. Participant ethnicity reflects that of the St. Louis community. There were no relationships between participant demographics (age, ethnicity, gender, parental education, medication status) and study variables; thus, they were not included in the presented analyses.

Procedure

The current findings are part of a larger study investigating negative symptoms utilizing EMA (Moran, Culbreth, & Barch, 2017). Participants completed a diagnostic interview and received training using a smartphone. Training consisted of instructing participants on using the phone along with reviewing questions on the EMA survey to ensure comprehension and ability to answer questions. For the next 7 days participants completed the EMA assessment responding to beeps 5 times per day (4 daytime surveys, 1 night survey). Following completion of the 7-day EMA period, participants returned to the laboratory and completed questionnaires assessing habitual emotion regulation. Participants were paid $1.75 for each EMA survey they completed and $40 per study visit.

Emotion regulation

Participants completed the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), a 10-item questionnaire assessing habitual use of cognitive reappraisal and suppression. Participants also completed the Savoring Beliefs Inventory (SBI; Bryant, 2003). The SBI includes a measure of people's beliefs about their ability to savor positive emotions in the present, past, and future.

Social functioning

The Specific Level of Functioning Scale (SLOF; Schneider & Struening, 1983) was used as a measure of functional status. The SLOF assesses domains including functioning in interpersonal relationships, participation in community, and work activities. We focused on the domain of interpersonal relationships for the present study given previous literature connecting emotional experience, regulation, and social functioning (e.g., Lopes et al., 2005). Given the high rate of discrepancy between self- and informant reports (Bowie et al., 2007), we obtained both self- and informant reports of functioning. Informants included a person close to the participant, such as a family member, case worker, or therapist.

Table 1. Demographics and Clinical and Self-Report Measures

	M	*SD*	%	*n*
Age	39.48	8.40		
Sex (% female)			48	
Education	12.81	2.86		
Parental education	14.23	3.56		
Estimated IQ	95.21	16.65		
Race				
African American			67	
Caucasian			33	
Clinical ratings				
BPRS positive symptoms	8.52	5.18		
CAINS MAP	18.23	6.22		
CAINS EXP	5.85	3.59		
Medication				
Typical antipsychotics				6
Atypical antipsychotics				26
Medications				2
Self-report measures				
ERQ reappraisal	28.17	8.53		
ERQ suppression	15.53	6.15		
SBI savoring	5.73	5.62		
SLOF—Informant	28.90	2.34		
SLOF—Self-report	27.19	6.24		
EMA ratings				
Positive affect	3.52	0.96		
Negative affect	1.65	0.84		
Social interaction	3.03	0.84		
Social interest	3.39	0.81		

Note: BPRS Psychosis = Psychosis Subscale of the Brief Psychiatric Rating Scale; CAINS EXP = Expression Subscale of the Clinical Assessment Interview for Negative Symptoms; CAINS MAP = Motivation and Pleasure Subscale of the Clinical Assessment Interview for Negative Symptoms; ERQ = Emotion Regulation Questionnaire; Estimate IQ = premorbid IQ based on Wechsler Test of Adult Reading (Wechsler, 2001); SBI = Savoring Beliefs Inventory; SLOF = specific level of functioning Interpersonal Relationship Sub-Scale; Social interaction = mean number of people interacted with daily; Social interest = mean interest in daily social interactions.

We obtained informant reports on 25 of the 34 patients included in the present analyses. Participants with SLOF informant reports did not differ significantly on age, parental education, estimated IQ, CAINS, or BPRS score (ps > .18) or on EMA completion rate, emotion regulation strategies, or EMA measures (ps > .25).

EMA

Participants completed EMA surveys on Android-enabled smartphones provided to participants for use during the study. Participants were asked to complete a daily daytime EMA questionnaire four times per day for 7 days between the hours of 10:00 AM and 7:00 PM and one nighttime survey at 8:00 PM. The mean response rate for the daytime data was 80%. In addition to the daytime surveys, participants were also asked to complete a nightly survey at approximately 8:00 PM each evening. The mean response rate for the nighttime surveys was 83%. Consistent with prior EMA research (e.g., Myin-Germeys, Nicolson, & Delespaul, 2001), four participants who fell below the 33% completion rate for either day- or nighttime surveys were excluded from analyses, yielding a final sample of 30.

During the daytime survey, participants were asked about their emotional experience at the time of the beep on a 5-point scale (1 = *not at all* to 5 = *extremely*). Discrete emotions assessed were as follows: happy, calm, sad, and anxious. We chose to assess happiness and sadness given these are emotions frequently targeted in laboratory assessments examining emotion regulation. We included calm and anxious as a lower arousal positive and negative emotional experience. Positive (happy and calm; Cronbach's alpha = .84) and negative (sad and anxious; Cronbach's alpha = .75) composite scores were used in the current analyses.[1] The night EMA survey did not ask about emotional experience but did ask participants to reflect on their day and report the number of people they spent time with that day, which served as our measure of daily social interaction. In addition, participants were asked (a) how interested they were in those interactions and (b) how much they wanted to be with other people that day (1 = *not at all* to 5 = *extremely*). These served as our composite measure of daily social interest (Cronbach's alpha = .88).

Analyses

We used hierarchical linear modeling (HLM) in HLM 7.0 (Raudenbush, Bryk, Cheong, & Congdon, 2004) to investigate relationships between within-subject observations of EMA (Level 1) and between-subject observations including emotion regulation strategies (Level 2). HLM is suitable for EMA designs because it accounts for the nested structure of multiple observations within each subject. Moreover, HLM allows for missing or unbalanced data, which is common in EMA designs where participants do not respond to all prompts. We conducted separate models for each emotion regulation strategy (Level 2), with regulation strategy as a fixed between-subject variable to predict daily emotional experience (positive or negative emotion), social interaction, and social interest within each subject. Participant repeated EMA ratings were entered as random effects in Level 1. A model looking at the relationship

Table 2. Results From Hierarchical Linear Models Using Emotion Regulation Strategies to Predict Daily Emotional Experience and Social Interaction

	Reappraisal			Suppression			Savoring		
Dependent variable	*b*	*t*	*p*	*b*	*t*	*p*	*b*	*t*	*p*
Positive emotion	.34	5.32	.001	−.28	−5.36	.005	.17	3.36	.02
Negative emotion	−.03	−1.12	.48	.36	6.59	.001	−.19	−4.50	.01
Social interaction	.09	1.20	.33	−.21	−4.36	.01	.24	5.96	.002
Social interest	.11	1.30	.40	−.30	5.76	.003	.31	6.32	.001

between SLOF social functioning (Level 2) and EMA ratings of emotional experience and social functioning (Level 1; random effect) was also computed to examine the relationship between measures of functioning and daily reports of functioning. For all HLM models, method of estimation used was restricted maximum likelihood. We computed correlations between emotion regulation strategies, clinical symptoms, and SLOF scores. Bonferroni corrections were used for correlational analyses.

Results

Cognitive reappraisal

We first examined the relationship between cognitive reappraisal, emotional experience, and social functioning in daily life. As shown in Table 2, we found a significant relationship between self-reported habitual use of reappraisal and positive affect in daily life such that greater use of reappraisal was associated with more positive emotion in daily life. However, inconsistent with our hypotheses, we did not find a significant relationship between reappraisal and negative emotion, social interaction, or social interest in daily life. There was no significant relationship between reappraisal and social functioning as measured by the SLOF self (r = .03, p = .87) or informant report (r = .11, p = .63). Further, cognitive reappraisal was not significantly related to CAINS MAP (r = −.30, p = .12), EXP (r = −.19, p = .32), or BPRS Positive symptoms (r = −.13, p = .51).

Suppression

Consistent with our hypotheses, when examining the relationship between self-reported habitual suppression and emotional experience, we found that greater self-reported habitual use of suppression was related to greater negative emotion reported in daily life via EMA (Table 2). Greater levels of suppression were also related to reduced positive emotion, social interaction, and social interest in daily life (Table 2). There was no significant relationship between suppression and SLOF social functioning in self- (r = −.10, p = .59) or informant report (r = .14, p = .47). Suppression was significantly related to CAINS EXP (r = −.45, p < .05), however it was not related to CAINS MAP (r = .23, p = .24) and BPRS positive symptoms (r = −.21, p = .26).

Savoring

Consistent with our hypotheses, we found that self-reported savoring of positive emotion as measured by the SBI was related to greater positive emotion, decreased negative emotion, greater social interaction, and greater social interest in daily life (Table 2). Savoring was not significantly related to the SLOF social functioning scale self- (r = .17, p = .39) or informant report (r = .20, p = .26). Savoring was significantly related to CAINS MAP (r = −.36, p < .05) and CAINS EXP (r = −.39, p < .05). Savoring was not related to BPRS positive symptoms (r = −.14, p = .45).

SLOF social functioning

We found a significant relationship between SLOF social functioning informant report and our social interest measure (B = .42, p < .005), but no relation to positive or negative emotion or social interaction (ps > .30) We found no relationship between self-reported SLOF social functioning and positive emotion, negative emotion, social interest, or social interaction in daily life (ps > .27). Further, SLOF social functioning from either informant or self-report was not related to CAINS MAP, EXP, or BPRS positive symptoms (ps > .35).

Discussion

The goal of the current study was to examine the relationship between self-reported habitual use of emotion regulation strategies and emotional and social functioning in the daily lives of those with schizophrenia. Consistent with research in healthy controls, we found that habitual use of emotion regulation strategies has important links to both the experience of emotion and social interaction in daily life. We discuss each regulation strategy and related findings below.

Similar to findings in healthy adults, we found that individuals with schizophrenia who reported greater habitual use of cognitive reappraisal were more likely to report greater positive emotion while going about their daily lives. In contrast to previous findings in healthy controls (Goldin, McRae, Ramel, & Gross, 2008; Gross & John, 2003), habitual use of cognitive reappraisal in schizophrenia was not related to reduced negative emotion. This finding is also inconsistent with laboratory-based studies that found negative emotion decreased in schizophrenia following specific instruction to reappraise their emotional response to a sad mood induction (e.g., Perry et al., 2012). It may be that in schizophrenia, reappraisal is effective at reducing negative emotion immediately following reappraisal in a more controlled setting but may not relate to more sustained reductions in negative emotion in more natural settings. It may also be the case that reappraisal did not relate to the down-regulation of sadness and anxiety assessed in the current study but would relate to reductions in other negative emotions, such as anger or guilt. Future studies utilizing EMA should investigate the short- and long-term effects of cognitive reappraisal in schizophrenia and healthy controls to highlight the temporal relationship between reappraisal and negative emotional experience, clarifying if and when negative emotional response is reduced. It is also noteworthy that while reappraisal did relate to daily positive emotion, it did not relate to negative symptoms or social functioning. While this replicates prior findings from Henry and colleagues (2008), who found no relationship between reappraisal and symptom ratings, this lack of relationship is somewhat surprising given that reappraisal is thought to be an adaptive strategy linked to functioning and emotional well-being. These findings suggest that reappraisal may not be effectively linked to important clinical outcome measures that are used across studies. It will be important for future work to examine whether consistent use of reappraisal over time does relate to changes in symptoms or functioning, to help clarify whether reappraisal is an important therapeutic intervention.

The second regulation strategy we focused on in the present study was emotional suppression. Given that schizophrenia has long been associated with diminished emotional expression, which is linked to poor outcomes (e.g., Gur et al., 2006), suppression may be a regulation strategy relevant to understanding poor psychosocial function in schizophrenia. Our current findings suggest that those with schizophrenia who report greater habitual use of suppression also report greater negative emotion and reduced positive emotion when assessed in daily life. Moreover, emotional suppression was related to less social interaction and interest in daily life and clinician-rated reductions in expressivity. These findings fit within the model of emotional suppression as a potential maladaptive strategy in healthy controls (e.g., John & Gross, 2004) and in schizophrenia (Perry et al., 2012). These findings also fit with previous literature linking flat affect with reduced social relationships and social functioning in schizophrenia (Evensen et al., 2012). Indeed, a main component of social skills training for people with schizophrenia involves teaching common forms of communication, such as a smile when greeting others or expressing and sharing feelings with others, which may help to reduce the use of suppression.

The final regulation strategy investigated in the present study was the savoring of positive emotion. Basic emotion research has shown that savoring of positive emotion is linked to a host of positive outcomes including increased positive emotion, reduced negative emotion, and greater feelings of well-being and social functioning (e.g., Bryant, 2003; Livingstone & Srivastava, 2012; Quoidbach et al., 2010). Consistent with these findings, habitual use of savoring was related to greater positive emotion, reduced negative emotion, and greater social interaction and interest in the daily lives of those with schizophrenia. Habitual use of savoring was also related to clinician-rated negative symptom ratings of motivation and pleasure, pointing to the potential importance of savoring of positive emotion in the lives of those with schizophrenia. In a pilot study examining the effectiveness of meditation in schizophrenia, Johnson and colleagues (2011) found that following a brief meditation intervention, people with schizophrenia showed an increase in positive emotion, which was linked to savoring of future positive emotion. Our findings support this link between savoring and experience of positive emotion in daily life, suggesting that savoring may be a potential target for intervention. Given that savoring has received limited attention thus far in schizophrenia, future work should look to examine regular usage of savoring and further explore potential adaptive and maladaptive correlates of this regulation strategy.

One additional aim of the current study was to examine multiple measures of social functioning and their relationship to emotion regulation. We found that daily social interest, and interactions, but not self- or informant reports of social function on the SLOF, related to emotion regulation strategy use. These findings may suggest that emotion regulation relates to the day-to-day social experiences of individuals with schizophrenia but is not an important influence in the overall social functioning as measured by the SLOF. This contrast in findings may be due to differences between the two measures of social functioning. Our EMA measures

of social involvement assessed both the number of people participants interacted with each day along with their interest in those social interactions. In contrast, the SLOF asks participants and their informant to reflect on current social functioning across a variety of domains including effective communication, participation in groups, and maintaining friendships. Further, our measure asked participants to report their interactions each day, rather than sum their experience over 30 days as the SLOF does, thus requiring participants to recall experiences over a shorter period of time. It is unclear if one measure of social involvement is more or less important to our understanding of patient functioning; rather, they may represent somewhat distinct components of social functioning. Moreover, we found that daily social interest, but not quantity of social interactions, related to informant-reported social functioning (as measured by the SLOF). This suggests that level of interest may be a more relevant marker of overall functioning than a measure relating solely to the quantity of social interactions. Indeed, while a person may report a number of social interactions, this does not gauge the quality of these interactions. It may be that a handful of highly engaged interactions are more relevant to social functioning than overall number of interactions.

Finally, neither daily reports of social interest nor interaction were related to self-reported social functioning on the SLOF. This finding is consistent with prior work suggesting an important disconnect between informant and self-reported functioning with patients over- or underestimating functioning relative to their informant (e.g., Bowie et al., 2007; Sabbag et al., 2012). Future work examining the link between self- and informant-based social functioning measures and ecological assessments of social interactions will be important to clarify and extend our understanding of how to assess social functioning in the daily lives of people with schizophrenia. Taken together, our findings suggest that daily interest in social activity is closely related to both informant reports of social functioning and habitual emotion regulation but may not be related to self-assessment of global social skills.

The present study had several limitations. First, we chose to assess only four distinct emotions and collapsed these into composite measures of positive and negative affect. It may be the case that certain discrete emotions may be more impacted by various regulatory strategies (e.g., suppressing sadness vs. suppressing anger). It will be important for future studies to not only assess a wider range of emotions but to potentially take a discrete emotion approach to investigate whether distinct emotions (e.g., fear, happiness) are more specifically related to emotion regulation and well-being in schizophrenia. Second, while the structure of EMA data allows for the assessment of emotional variations across the day/week, we did not have specific hypotheses about how emotional responses would vary by time of day or day of the week. Thus, the present analyses did not include specific predictors related to time and do not provide insight into variations in emotional experience or social interaction as a function of emotion regulation. Future studies, assessing emotion regulation via EMA will be better able to hypothesize and examine variance in emotional response following emotion regulation and thus be better able to clarify the immediate linkages between regulation and emotional responses. Third, while we had the power to detect significant relationships, our sample size was modest. Fourth, nighttime surveys assessing participants' social interaction throughout the day required participants to reflect upon the day rather than report their experience in the moment. While this relies on participants' ability to retrospectively recall their social interactions across the day, this still represents an important complement to measures that require participants to recall their interactions across a week or more. Future studies should include assessment of social experience throughout the day to gain a more refined view of social response. Finally, control participants were not included in the current study; thus, we are unable to make claims about group differences in use of emotion regulation or in how these strategies relate to emotional and social experience in the everyday life of healthy controls. Based on extensive prior literature, we would expect that healthy controls would show similar relationships as seen in the present study, though we do not think this diminishes the importance of establishing the relevance of habitual use of emotion regulation strategies in relationship to daily life function in schizophrenia.

The current study adds to a growing literature investigating emotion regulation, emotional experience, and social functioning in schizophrenia. Our findings demonstrate that the habitual use of emotion regulation strategies such as cognitive reappraisal and savoring relate to the experience of greater positive emotion in the daily lives of those with schizophrenia. In contrast, we found that the habitual use of suppression is related to greater negative emotion, reduced positive emotion, and decreased social engagement in daily life. These findings are largely consistent with results in healthy control populations, suggesting that emotion regulation has similar benefits and costs. Future research should look to clarify the temporal dynamic of these relationships to better understand the relationship between regulation, emotional experience, and functioning in daily life.

Author Contributions

All the authors designed the study. E. K. Moran and A. J. Culbreth collected the data. The statistical analyses were performed by E. K. Moran. E. K. Moran drafted the manuscript, and all the authors provided critical revisions. All the authors approved the final version of the manuscript for submission.

Declaration of Conflicting Interests

E. K. Moran and A. J. Culbreth report no conflicts of interest. D. M. Barch has consulted for Pfizer, Amgen, Roche, and Takeda and has a contract to analyze imaging data for Pfizer.

Note

1. While results are presented looking at positive and negative composite scores, a similar pattern of findings was found examining each emotion independently.

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