Positive Emotion in Daily Life: Emotion Regulation and Depression

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Depression is associated with the infrequent use of emotion regulation strategies that increase positive emotion and the frequent use of strategies that decrease positive emotion. However, prior research mostly relies on global, retrospective assessments that fail to capture dynamic relations between positive emotion and emotion regulation in ecologically valid settings. This study used an ecological momentary assessment (EMA) design to test whether depression is related to positive emotion regulation in daily life. We recruited 108 individuals to complete a 14-day EMA study, tracking strategy use and positive emotion over time. Higher momentary positive emotion was associated with greater subsequent use of positive rumination and less use of dampening. Elevated depressive symptoms, however, were associated with lower average use of positive rumination and higher average use of dampening. Depressive symptom levels did not modulate relations between positive emotion and emotion regulation strategy use. Less use of positive rumination and more use of dampening were related to lower levels of momentary positive emotion. Taken together, depression was associated with a pattern of strategy use that is associated with low positive emotion. Emotion regulation may help to explain positive emotion deficits in depression.

Keywords: depression, emotion regulation, dampening, positive rumination, ecological momentary assessment

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Depression is a disorder of emotion. Emotion dysregulation in depression is clearly evident in the hallmark symptoms of the disorder (American Psychiatric Association, 2013), and decades of empirical work show that depression is associated with elevated levels of negative emotion and low levels of positive emotion (Bylsma et al., 2011; Khazanov & Ruscio, 2016; Watson et al., 1988). Difficulties in the regulation of emotion are proposed to contribute to emotion dysfunction in depression (Aldao & Nolen-Hoeksema, 2010; Joormann & Stanton, 2016; Liu & Thompson, 2017). Emotion regulation (ER) refers to the ability to modulate the intensity, frequency, and duration of emotional responses, and the ways in which people regulate their emotions are known as ER strategies (Gross, 1998, 2014). Most research on depression narrowly focuses on the regulation of negative emotion (Liu & Thompson, 2017; Visted et al., 2018), but individual differences in ER may also help in our understanding of low levels of positive emotion. Of note, there is a paucity of research on the regulation of positive emotion and its relation to depression. This empirical gap is critical given prior work showing that diminished levels of positive emotion and hypoactivation in brain regions that underlie positive emotion distinguish depression from other forms of psychopathology (Watson et al., 1988), relate to a worse course of depression (Vrieze et al., 2013), and predict poor treatment response (Forbes et al., 2010; McMakin et al., 2012; Spijker et al., 2001). It is therefore particularly important to investigate whether problems with ER explain low levels of positive emotion as they relate to depressive symptoms.

Depression has been linked to difficulties in using ER strategies that actively serve to increase or maintain positive emotion (Feldman et al., 2008; Werner-Seidler et al., 2013). One of the most commonly studied strategies aimed at increasing or maintaining positive emotion is positive rumination. Positive rumination is defined as a cyclical style of thought in which individuals perseverate on the nature of positive emotion and its consequences (Feldman et al., 2008; Gruber et al., 2011, 2009). There are two forms of positive rumination—emotion-focused positive rumination and self-focused positive rumination. Whereas emotion-focused positive rumination centers on the experience of emotion (e.g., thinking about how happy one feels), self-focused positive rumination centers on how the individual contributed to the causes (e.g., thinking, “I am getting everything done”) and consequences (e.g., thinking, “I am living up to my potential”) of positive emotion (Feldman et al., 2008). There is little evidence linking depression to positive rumination; however, one notable exception shows an inverse relation between depressive symptoms and the habitual use of positive rumination (Harding et al., 2014). Further,
there is some evidence revealing that the infrequent use of self-
and emotion-focused positive rumination is linked to elevated
levels of depression-related anhedonia (e.g., Werner-Seidler et al.,
2013). Not only does empirical work find that depression is related
to difficulties in up-regulating positive emotion, but depression is
also linked to strategies that decrease positive emotion (e.g., Feld-
man et al., 2008).

One of the most commonly studied ER strategies aimed at
reducing positive emotion is dampening. Dampening entails neg-
ative appraisals of the nature (e.g., reminding oneself, “These
feelings won’t last”) and consequences of positive emotion (e.g.,
thinking, “I don’t deserve this”), and it serves to attenuate positive
emotion (Feldman et al., 2008). Few studies examine the use of
these strategies in depression. Some notable exceptions have doc-
umented that individuals with elevated, compared to low, levels of
depressive symptoms exhibit different responses to positive emo-
tion (Feldman et al., 2008; Werner-Seidler et al., 2013). For
example, individuals with greater depressive symptoms report
greater engagement in dampening following the elicitation of
positive emotion (Nelis et al., 2015; Raes et al., 2012; Werner-
Seidler et al., 2013). Increased use of dampening is also linked to
elevated levels of depression-related anhedonia (Werner-Seidler et
al., 2013).

While research has made advances in identifying positive ER
difficulties in depression, one critical limitation is that prior re-
search efforts almost exclusively utilize global, retrospective re-
ports of ER strategy use, which measure more trait-like character-
istics of implementing these strategies. To date, there is a dearth of
research in ecologically valid settings that is aimed at gaining a
better understanding of the dynamic features of positive ER related
to depression by studying the regulation of positive emotion and
positive emotion in real time. Two notable exceptions have studied
the relation between depression and positive ER processes in daily
life. Using an ecological momentary assessment (EMA) paradigm,
Carl and colleagues (2014) examined people’s ER goals (i.e.,
whether they wanted to increase or decrease positive emotion) and
investigated the relation between one’s goals and subsequent
changes in emotion. They found that depressive symptoms were
not associated with positive ER goals. However, people with
elevated depressive symptoms exhibited greater declines in posi-
tive emotion after endorsing a down-regulatory goal. Although
certainly related, ER goals and strategy use are thought to repre-
sent distinct constructs (Tamir, 2009). People tend to use strategies
that are congruent with their goals (Tamir, 2016), but research has
yet to show that goals predict the implementation of specific ER
strategies. Importantly, though, prior work highlights that certain
ER strategies are more problematic in depression than others
(Aldao et al., 2010). Thus, there is a need to examine the relation
between depressive symptoms and specific positive ER strategies.

Only one study has examined the relation between depressive
symptoms and specific positive ER strategies in daily life (Li et al.,
2017). The authors utilized a daily diary paradigm in which they
assessed positive events, positive emotion, strategy use, and
depressive symptoms once daily for 14 days. They investigated
whether the association between positive events and depressive
symptoms was moderated by the extent to which individuals
engaged in dampening and positive rumination (Li et al., 2017).
Positive events were associated with less depressive symptoms and
with more positive emotion when participants endorsed relatively
lower levels of dampening. Counter to the author’s predictions,
positive events were associated with less depressive symptoms and
more positive emotion when participants endorsed relatively lower
levels of positive rumination. Despite these exciting findings, the
assessment paradigm included only one survey per day. Given the
dynamic nature of emotion and ER, establishing relations between
such constructs repeatedly over time is essential to more clearly
demonstrate that problems with positive ER are associated with the
low levels of positive emotion putatively associated with depres-
sion. Therefore, the current study used an EMA task that included
six surveys per day for 14 days to examine the relation between
strategy use and positive emotion over time and the degree to
which depressive symptoms moderated this relation.

To our knowledge, the current study is the first to leverage the
strengths of an EMA paradigm to advance the understanding of the
relation between depressive symptoms, the use of positive ER
strategies (i.e., dampening, emotion-focused positive rumination,
self-focused positive rumination), and momentary positive emo-
tion in people’s daily lives. Adopting a dimensional approach to
study these psychological processes along the continuum of de-
pressive symptom severity, we sought to address two overarching
aims.

The first aim was to examine the relation between ER strategy
use and momentary positive emotion and to test the degree to
which depressive symptoms moderated this relation. Consistent
with cross-sectional findings on the relation between strategy use
and emotion (Li et al., 2017), we predicted that engagement in both
forms of positive rumination would be associated with greater
levels of momentary positive emotion. In contrast, use of damps-
ening was expected to be related to lower levels of positive
emotion. To determine the role of depressive symptom severity,
we explored whether depression severity potentiated or inhibits
the relation between ER strategy (i.e., positive rumination, dampen-
ning) and momentary positive emotion. Given the exploratory
nature of this question, specific predictions regarding the degree to
which depression may enhance or hinder the emotional effects of
a given ER strategy were not made.

The second aim was to investigate whether positive emotion
predicted subsequent strategy use and to again test the moderating
role of depressive symptoms. In line with prior work showing that
adults typically seek to maintain or increase positive emotions
(Riediger et al., 2009), it was hypothesized that positive emotion
would be related to greater subsequent engagement in self- and
emotion-focused positive rumination and less engagement in
dampening. Investigating the role of depression severity, we tested
whether depressive symptoms were related to the average use of
positive ER strategies in daily life and whether symptom severity
modulated the relation between positive emotion and subsequent
ER strategy use. Based on findings from cross-sectional studies
(Feldman et al., 2008; Werner-Seidler et al., 2013), we hypothe-
sized that depressive symptoms would be linked to greater overall
use of dampening and to less overall use of both self- and emotion-
focused positive rumination. Further, we explored whether depres-
sive symptom severity moderated the relation between positive
emotion and subsequent strategy use. Although exploratory, the
relation between positive emotion and subsequent dampening was
predicted to be stronger among individuals with elevated depressi-
sive symptoms; higher levels of positive emotion were expected to
be followed by greater engagement in dampening among individ-
uals with relatively more depressive symptoms but not among individuals with less depressive symptoms. Conversely, the relation between positive emotion and subsequent emotion- and self-focused positive rumination was predicted to be weaker among individuals with greater depressive symptoms; here, greater positive emotion was expected to be associated with more engagement in emotion- and self-focused positive rumination among participants endorsing relatively fewer depressive symptoms but not among those reporting elevated symptoms.

Method

Participants

Participants were recruited using online advertisements and flyers within the New Haven, CT community. To qualify for the current study, individuals had to be between the ages of 18 and 65, be proficient in the English language, and possess a cellular device with Internet capabilities. Exclusion criteria included self-reported history of a neurological disorder, learning disability, and colorblindness. Additional exclusion criteria included a history of hypomania or mania, a history of psychotic symptoms, and elevated risk for a substance use disorder as determined by scores on a self-report questionnaire. These psychological exclusion criteria were chosen given that prior research has documented unique disruptions in positive emotion associated with substance use (Berridge & Robinson, 2016), bipolar disorder (Johnson et al., 2012), and psychotic symptoms (Gard et al., 2007).

Of those deemed eligible for participation, 116 people initially enrolled in the study. However, eight people did not complete at least 25% of the EMA surveys and, consistent with prior research (cf. Gruber et al., 2013), were not considered in the analyses. This resulted in a final sample of 108 individuals, which was consistent with prior EMA studies on ER (e.g., Pe et al., 2013). Of note, imposing higher compliance thresholds (e.g., 50%) did not alter the results reported in this article (see the sensitivity analyses reported below). The sample included 73 women and 35 men. Ages ranged from 18 to 64 years old ($M = 32.19$, $SD = 10.99$). Across participants, 48.1% identified as White or Caucasian, 24.1% identified as Black or African American, 10.2% identified as Asian or Asian American, 11.1% identified as Hispanic or Latino, and 6.5% identified as “other” or mixed race. Regarding educational attainment, 2.8% of participants did not complete high school, 20.4% earned a high school diploma, 27.8% completed some college or vocational training or earned an associate degree, 32.3% earned a bachelor’s degree, and 16.7% earned a master’s, professional, or doctoral degree. Regarding depression, participants exhibited considerable variability in self-reported depressive symptoms (measurement of symptoms described in greater detail below). Indeed, scores on the Beck Depression Inventory-II (Beck et al., 1996) ranged from 0 to 41 ($M = 9.82$, $SD = 8.65$). Using established cutoff scores to determine depression severity (Beck et al., 1996), 71.6% of participants fell in the range indicating minimal depressive symptoms, 13.7% fell in the mild depression range, 10.8% fell in the moderate depression range, and 3.9% fell in the severe depression range. Further, 14 participants within the current sample met criteria for a current major depressive disorder based on the Structured Clinical Interview for DSM-5 that was administered to screen participant eligibility (described in greater detail below). All study procedures were approved by the institutional review board at Yale University, and all participants provided informed consent prior to participating in the current study. Participants were compensated $10 per hour for the laboratory session, which lasted approximately 1.5 hr, and they were paid $0.50 for each EMA survey they completed. Consistent with the recommendations of Conner and Lehman (2012) and similar to prior emotion research using EMA paradigms (e.g., Thompson et al., 2011; Wu et al., 2017), participants with high survey completion rates earned a bonus payment. In the current study, participants received an $8 bonus if they completed at least 80% of the EMA surveys.

Materials

Questionnaires Used for Assessing Study Eligibility

A prescreening questionnaire was used to collect patient demographic information, including age, race, educational attainment, and self-reported history of a neurological disorder, learning disability, and colorblindness. Moreover, the Psychosis Screening Questionnaire (PSQ; Bebbington & Nayani, 1995) was used to assess for psychotic symptoms. The PSQ was scored using the algorithm described by Bebbington and Nayani (1995), and individuals who were deemed at risk for psychosis based on their responses were also deemed ineligible. Furthermore, the Alcohol Use Disorders Identification Test (AUDIT; Babor et al., 1992) and the Drug Use Disorders Identification Test (DUDIT; Berman et al., 2005) were used to screen for risk for alcohol and substance use disorders, respectively. Individuals who scored a 20 or higher on the AUDIT or a 25 or higher on the DUDIT were deemed ineligible for the current study given their increased risk for a substance use disorder (Berman et al., 2005, 2008; Conigrave et al., 1995). The cutoff score for the AUDIT was higher than the traditional cutoff score of 8. A higher cutoff score was selected based on previous work documenting that such scores are associated with increased specificity for detecting significant alcohol problems (Conigrave et al., 1995). The PSQ, AUDIT, and DUDIT were administered as part of the prescreening questionnaire battery.

Structured Clinical Interview for DSM-5 (SCID-5)

The mood module from the SCID (First et al., 2015) was used to assess for a history of mania or hypomania. Trained, doctoral-level, graduate students administered the SCID during the in-person laboratory session, and diagnostic interrater reliability was strong ($K = .91$). As noted, participants who met full diagnostic criteria for either a current or past episode of mania or hypomania were excluded. Two individuals were deemed ineligible for enrollment in the current study based on the SCID interview.

Beck Depression Inventory-II (BDI-II)

The BDI-II (Beck et al., 1996) is a 21-item measure of depression symptom severity in the past 2 weeks. Items map onto the core features of major depressive disorder and are rated on a 4-point Likert scale ranging from 0–3. The BDI-II is one of the most commonly used measures of depression severity, and it has
strong psychometric properties (Beck et al., 1996). Internal consistency in the current study was excellent (α = .93).

**EMA Measures**

Measures of ER strategy use and state emotion were included within the EMA paradigm. The current study was part of a larger EMA study. The research questions addressed within the present study were a priori. See Supplemental Materials 1 for a full list of EMA questionnaire items, including those that were not included within the present article.

**Emotion Regulation.** Items from the Responses to Positive Affect (RPA; Feldman et al., 2008) scale were used to assess dampering as well as self- and emotion-focused positive rumination. Prior research has documented that the RPA (Feldman et al., 2008) possesses good psychometric properties, including high internal consistency and test–retest reliability (Dempsey et al., 2011; Feldman et al., 2008; Olofsson et al., 2014; Raes et al., 2010). To minimize participant burden at each EMA questionnaire, the three items with the highest loadings onto the dampening subscale of the RPA were used to index use of dampening since the prior EMA assessment. Specifically, participants responded to the items “How much were you thinking, ‘My streak of luck is going to end soon’?”; “How much were you thinking, ‘I don’t deserve to feel good’?”; and “How much were you thinking about things that could go wrong?” since the last survey they completed. As for emotion-focused and self-focused positive rumination, the two items with the highest loadings onto each positive rumination subscale of the RPA were used to assess these ER behaviors since the last EMA assessment. Emotion-focused positive rumination was assessed by “How much were you thinking about or noticing how good you felt?” and “How much were you thinking about or noticing how strong you felt?” Self-focused positive rumination was measured by “How much were you thinking, ‘I am achieving everything’?” and “How much were you thinking, ‘I am living up to my potential’?” Within- and between-subjects reliability coefficients were calculated following Bolger and Laurenceau (2013). For dampening, the within-subject reliability was .52, and the between-subjects reliability was .69. For emotion-focused positive rumination, the within-subject reliability was .62, and the between-subjects reliability was .80. For self-focused positive rumination, the within-subject reliability was .71, and the between-subjects reliability was .88.

Participants were given the following instructions:

People think and do many different things when they feel or want to feel positive emotions (e.g., love, joy, hope, contentment). The next questions ask you about how much you were doing certain things since the last survey you completed.

A 5-point scale, where 1 indicated not at all and 5 indicated extremely, was used to quantify the extent to which participants engaged in each RPA item. Higher scores indicated greater use of the given ER strategy. A sum score was calculated for each of the ER strategies.

**State Emotion.** Participants rated state levels of four discrete positive emotions (joy, love, hope, contentment) using a 5-point scale, where 1 indicated not at all and 5 indicated extremely. Specifically, they were asked to indicate the extent which they were experiencing each emotional state “right now.” These emotions were chosen because they have been shown to comprise the most frequently experienced positive emotions among community participants (Trampe et al., 2015), and prior research on the relation between emotion and clinical symptoms has assessed these positive emotional states given their high frequency (Gruber et al., 2013). Consistent with prior EMA research (Li et al., 2017), responses to the four emotion items were summed, yielding a total score of current positive emotion. Greater values reflected higher levels of positive emotion. The within-subject reliability was .79, and the between-subjects reliability was .88.

**Procedure**

Participants were invited to complete a laboratory session if deemed eligible based on their responses to the prescreening questionnaire. During the initial laboratory session, participants received instructions regarding the EMA procedure. The delivery of the EMA paradigm was modeled after prior EMA research (Kuppens et al., 2010; Pe et al., 2013). Consistent with other EMA studies (Kuppens et al., 2010; Li et al., 2017), participants were sent six EMA questionnaires per day for 14 days. EMA questionnaires were sent via SurveySignal (Hofmann & Patel, 2015) between the hours of 9 a.m. and 9 p.m. Questionnaires were pseudorandomly distributed within six 2-hr time segments over the 12-hr daily assessment window. There was a minimum of 45 min between any two questionnaires. EMA questionnaires were administered via Qualtrics (Qualtrics, Provo, UT). At the time of each assessment, SurveySignal sent a text message to participants instructing them that the next EMA questionnaire was ready, providing a link to the Qualtrics questionnaire. Item order was randomized at each survey. Participants had 45 min to complete the questionnaire before the link expired. On average, participants responded to 75.82% (SD = 17.39) of the EMA surveys, demonstrating good compliance comparable to prior research (Gruber et al., 2013).

An experimenter reviewed an information booklet regarding the EMA paradigm with participants during the laboratory session. In addition to reviewing the above-mentioned structure of the EMA paradigm, the booklet provided definitions of the four discrete positive emotions and instructions on how to complete the dampening and positive rumination questionnaire items. Participants were also sent home with a copy of the booklet to refer to throughout the EMA phase of the study. Next, participants registered their cellular phone with SurveySignal, which culminated in providing a link to the Qualtrics questionnaire that participants completed on their cellular device. Then, they completed a separate cognitive task (i.e., an emotion-modified Implicit Associations Task; Markovitch et al., 2017), which was included as part of a separate research study. Afterward, participants completed a set of questionnaires, including a demographics questionnaire and the BDI-II, which marked the end of the laboratory session. Participants were then compensated for their participation in the initial laboratory session and sent home. The EMA paradigm began the day after the laboratory session and lasted for the following 14 days. Participants received an email from the principal investigator after the third day of the EMA paradigm providing them with an update regarding their completion rate across the first 3 days of the paradigm and assessing whether they had any questions or were experiencing any technical difficulties related to SurveySignal or Qualtrics. After com-
termination of the EMA paradigm, participants were invited back to the laboratory to receive their compensation pertaining to the EMA paradigm. Finally, participants were debriefed regarding the overall study aims.

Data Analysis

Multilevel modeling was used to address the study aims. This technique accounts for the nested structure of the data: measurement occasions ($r$: 1–84 EMA surveys) nested within persons ($j$: 1–108 participants). The statistical analyses were performed using R Version 3.6.3 (R Core Team, 2020) and the nlme package (Bates et al., 2015).

To address the first aim of this study, we constructed a series of multilevel models (separately for each ER strategy) examining whether emotion regulation strategy use at occasion $t$ (i.e., self-focused positive rumination, emotion-focused positive rumination, or dampening, which were assessed “since the last survey”) was associated with momentary positive emotion. At Level 1, we constructed a model in which emotion regulation strategy use at occasion $t$ was grand-mean centered. The Level-1 and Level-2 models were as follows:

### Level-1 Model

$\text{Depression Severity}_{ij} = \beta_{00} + \beta_{01} (\text{Depression Severity})_{ij} + r_{0j}$

### Level-2 Model

$\text{Depression Severity}_{ij} = \beta_{00} + \beta_{01} (\text{Depression Severity})_{ij} + r_{0j} + r_{ij}$

To address the second aim of this study, we constructed a series of multilevel models examining whether momentary positive emotion is related to subsequent use of ER strategies (i.e., self-focused positive rumination, emotion-focused positive rumination, or dampening). At Level 1, we modeled how positive emotion at occasion $t$ is related to emotion regulation strategy use reported at occasion $t$. Note that the outcome was assessed since the last measurement occasion, reflecting the use of a strategy between measurement occasions $t-1$ and $t$. The Level-1 predictor was person-mean centered. At Level 2, we allowed the parameters $\pi_{0j}$ and $\pi_{1j}$ to vary across persons and examined whether the Level-1 intercept and slope vary as a function of individual differences in depression severity. Depression severity was grand-mean centered. The Level-1 and Level-2 models were as follows:

### Level-1 Model

$\text{Positive Emotion}_{tj} = \pi_{0j} + \pi_{1j} (\text{ER Strategy Use}_{tj}) + e_{ij}$

### Level-2 Model

$\text{Positive Emotion}_{tj} = \beta_{00} + \beta_{01} (\text{Depression Severity})_{ij} + r_{0j} + r_{1j}$

Sensitivity analyses were conducted to determine the robustness of the results. The results of the sensitivity analyses demonstrated that the time between two consecutive measurement occasions, the compliance threshold, individual differences in anxiety levels, and gender differences did not alter the pattern of findings reported below. The output of these analyses is provided in Supplemental Materials 3.

Results

### Preliminary Analyses

Means, standard deviations, and intraclass correlation coefficients (ICCs) were estimated for positive emotion, self-focused positive rumination, emotion-focused positive rumination, and dampening using intercept-only models. For positive emotion, the mean level was 2.84 (95% CI [2.69, 2.98]), with standard deviations of 0.61 and 0.74 at the within- and between-subjects levels, respectively. The ICC for positive emotion was .59, indicating that 59% of the total variability in positive emotion was between persons and 41% was within-subject variance. For self-focused positive rumination, the mean level was 2.17 ([2.00, 2.35]), with standard deviations of 0.64 and 0.91 at the within- and between-subjects level, respectively. The ICC was .67. Thus, 67% of the total variance was between persons and 33% was within persons. For emotion-focused positive rumination, the mean level was 2.19 ([2.04, 2.35]), with standard deviations of 0.67 and 0.82 at the within- and between-subjects levels, respectively. The ICC was .60, suggesting that 60% of the total variance in emotion-focused positive rumination was between persons and 40% was within persons. For dampening, the mean was 1.45 ([1.37, 1.54]), with standard deviations of 0.43 and 0.45 at the within- and between-subjects levels, respectively. The ICC for dampening was .51, indicating that 51% of the variability was between persons and 49% was within persons.

Furthermore, the pattern of within- and between-subjects correlations between the ER strategies was inspected. The within-subject average correlations (i.e., within-subject relations between the variables across the EMA period) indicate that self-focused positive rumination was moderately correlated to emotion-focused positive rumination ($r = .56$, 95% CI [.55, .58]) but not related to dampening ($r = .08$, [.06, .11]). Dampening was not related to emotion-focused positive rumination ($r = .06$, [.04, .09]). The pattern of between-subjects correlations (i.e., correlations between the mean levels of the variables across all measurement occasions) was similar. A strong correlation emerged between self-focused and emotion-focused positive rumination ($r = .89$, [.85, .93]). Dampening was not related to self-focused ($r = .14$, [.05, .22]) or emotion-focused ($r = .19$, [.00, .37]) positive rumination.

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1. Additional models that included the autoregressive term of positive emotion were tested to investigate how emotion regulation strategy use is associated with changes in positive emotion from $t-1$ to $t$. The results of these analyses and a caveat to its interpretation are presented in Supplemental Materials 2.

2. As suggested during the review process, we also specified multilevel models that included between-subjects terms for all Level-1 variables as predictors of the random intercepts and slopes. However, no convergence was obtained for the new models. Simplified models (without random slopes) suggested no substantial changes in the parameter estimates of the within-subject parameters. Because simplified models with fixed slopes are less likely to reflect the complexity of relations between positive emotion and emotion regulation strategy use and do not allow us to test all our hypotheses regarding depression severity, we decided to report the results from models that included Level-1 variables that were person centered and Level-2 variables that were between-person centered. These models are similar to various other studies in this field of research and increase comparability of the results across studies (Haines et al., 2016; Kircanski et al., 2018; Pe et al., 2013).
Research Aim 1

Table 1 presents the results of the tested multilevel models to address the first study aim. With respect to self-focused positive rumination, a significant positive relationship was found between self-focused positive rumination and positive emotion at occasion t ($\beta_{20} = 0.305, p < .001$). This suggests that the use of self-focused positive rumination is associated with concurrent positive emotion in daily life. However, there was no significant association between depression severity and the positive emotion—self-focused positive rumination slope ($\beta_{21} = 0.001, p = .723$). This indicates that depressive symptoms do not moderate the relation between self-focused positive rumination use and momentary positive emotion.

The analyses on emotion-focused positive rumination revealed a significant positive relation between the use of this ER strategy and positive emotion at occasion t ($\beta_{20} = 0.350, p < .001$). This indicates that emotion-focused positive rumination use is associated with concurrent positive emotion in daily life. Again, depression severity did not moderate the relation between the use of emotion-focused positive rumination and positive emotion ($\beta_{21} = 0.001, p = .833$).

Finally, dampening was significantly related to positive emotion at occasion t ($\beta_{20} = -0.300, p < .001$). Higher levels of dampening were associated with lower levels of momentary positive emotion. As in the previous analyses, depression severity did not moderate the relation between dampening use and positive emotion ($\beta_{21} = 0.002, p = .625$).

Table 2 presents the results from the multilevel analyses addressing the second study aim. With respect to self-focused positive rumination, a significant positive relationship ($\beta_{10} = 0.169, p < .001$) was found between positive emotion at occasion t–1 and the use of this ER strategy between occasion t–1 and t. On average, higher levels of positive emotion were associated with greater subsequent use of self-focused positive rumination. Furthermore, depression severity was related to a person’s average level of self-focused positive rumination ($\beta_{01} = 0.027, p = .008$). Higher levels of depression severity were related to lower use of self-focused positive rumination. Finally, depression severity did not modulate the positive emotion (at occasion t–1)—self-focused positive rumination slope ($\beta_{11} = 0.001, p = .818$). This indicates that depression severity did not moderate the relation between a person’s reported positive emotion at occasion t–1 and use of self-focused positive rumination between occasion t–1 and t.

The analyses on emotion-focused positive rumination revealed a significant relation between the use of this ER strategy between occasion t–1 and t and positive emotion at occasion t–1 ($\beta_{10} = 0.211, p < .001$). Higher levels of positive emotion were associated with subsequent use of emotion-focused positive rumination. In addition, there was a trending relationship between depression severity and a person’s average level of positive emotion ($\beta_{01} = -0.017, p = .062$), suggesting that higher levels of depressive symptoms may be related to lower average levels of positive emotion.

Table 1
The Estimated Parameters From the Models Examining Research Question 1

<table>
<thead>
<tr>
<th>Model</th>
<th>Effect</th>
<th>Estimate</th>
<th>SE</th>
<th>t</th>
<th>p</th>
<th>Random effects</th>
<th>Effect</th>
<th>Estimate</th>
<th>Lower</th>
<th>Upper</th>
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<td>1</td>
<td>Intercept ($\beta_{00}$)</td>
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<td>0.066</td>
<td>42.547</td>
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<td>Intercept</td>
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<td>0.600</td>
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<td></td>
<td>Self-focused positive rumination at t ($\beta_{20}$)</td>
<td>0.305</td>
<td>0.027</td>
<td>11.119</td>
<td>&lt;.001</td>
<td>Self-focused positive rumination at t</td>
<td>0.240</td>
<td>0.200</td>
<td>0.288</td>
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<tr>
<td></td>
<td>Depression severity ($\beta_{01}$)</td>
<td>-0.035</td>
<td>0.008</td>
<td>-4.593</td>
<td>&lt;.001</td>
<td>Correlation intercept – Self-focused positive rumination at t</td>
<td>-0.073</td>
<td>-0.268</td>
<td>0.130</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depression Severity × Self-Focused Positive Rumination ($\beta_{21}$)</td>
<td>0.002</td>
<td>0.003</td>
<td>0.607</td>
<td>.544</td>
<td>Residual</td>
<td>0.558</td>
<td>0.549</td>
<td>0.568</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Intercept ($\beta_{00}$)</td>
<td>2.813</td>
<td>0.066</td>
<td>42.557</td>
<td>&lt;.001</td>
<td>Intercept</td>
<td>0.681</td>
<td>0.595</td>
<td>0.780</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Emotion-focused positive rumination at t ($\beta_{20}$)</td>
<td>0.350</td>
<td>0.027</td>
<td>13.102</td>
<td>&lt;.001</td>
<td>Emotion-focused positive rumination at t</td>
<td>0.236</td>
<td>0.198</td>
<td>0.282</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depression severity ($\beta_{01}$)</td>
<td>-0.035</td>
<td>0.008</td>
<td>-4.595</td>
<td>&lt;.001</td>
<td>Correlation intercept – Emotion-focused positive rumination at t</td>
<td>-0.099</td>
<td>-0.360</td>
<td>0.176</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depression Severity × Emotion-Focused Positive Rumination ($\beta_{21}$)</td>
<td>0.001</td>
<td>0.003</td>
<td>0.0211</td>
<td>.833</td>
<td>Residual</td>
<td>0.541</td>
<td>0.532</td>
<td>0.549</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Intercept ($\beta_{00}$)</td>
<td>2.813</td>
<td>0.066</td>
<td>42.561</td>
<td>&lt;.001</td>
<td>Intercept</td>
<td>0.681</td>
<td>0.594</td>
<td>0.780</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dampening at t ($\beta_{20}$)</td>
<td>-0.300</td>
<td>0.045</td>
<td>-6.677</td>
<td>&lt;.001</td>
<td>Dampening at t</td>
<td>0.384</td>
<td>0.319</td>
<td>0.462</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depression severity ($\beta_{01}$)</td>
<td>-0.035</td>
<td>0.008</td>
<td>-4.496</td>
<td>&lt;.001</td>
<td>Correlation intercept – Dampening at t</td>
<td>-0.180</td>
<td>-0.412</td>
<td>0.074</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Depression Severity × Dampening ($\beta_{21}$)</td>
<td>0.002</td>
<td>0.005</td>
<td>0.337</td>
<td>.736</td>
<td>Residual</td>
<td>0.580</td>
<td>0.570</td>
<td>0.590</td>
<td></td>
</tr>
</tbody>
</table>

Note. Positive affect at time t is the outcome variable for each of these models. SE = standard error; CI = confidence interval.
emotion-focused positive rumination. Finally, depression severity did not moderate the relation between positive emotion and emotion-focused positive rumination ($\beta_{11} = 0.001, p = .730$).

Finally, with respect to the use of dampening, positive emotion at occasion $t-1$ was associated with the use of dampening between occasion $t$ and $t+1$ ($\beta_{10} = -0.045$, $p = .002$). On average, higher levels of positive emotion were related to greater subsequent use of dampening. Furthermore, there was a significant relationship between depression severity and the average use of dampening ($\beta_{01} = 0.017$, $p < .001$). Higher levels of depressive symptom severity were related to greater use of dampening in daily life. Finally, there was no significant association between depression severity and the dampening—positive emotion slopes ($\beta_{11} = -0.001$, $p = .774$). This indicates that individual differences in depressive symptoms did not moderate the relation between positive emotion at $t-1$ and the use of dampening between $t-1$ and $t$.

**Discussion**

The current study used an EMA design to investigate the dynamic relation between positive ER strategies and positive emotion as well as how depressive symptom severity moderates this relation in daily life. The main findings were the following: (a) Greater use of self- and emotion-focused positive rumination was associated with greater levels of momentary positive emotion, whereas greater use of dampening was linked to lower levels of momentary positive emotion; (b) Positive emotion was associated with greater subsequent use of self- and emotion-focused positive rumination and less use of dampening; and (c) Depressive symptom severity was related to less use of self-focused positive rumination and greater use of dampening but did not moderate the relation between ER strategy use and momentary positive emotion or the relation between positive emotion and subsequent ER. Together, these results suggest that individuals with greater depressive symptom severity engaged in a profile of ER strategy use that was linked to lower levels of positive emotion. These results are discussed in turn.

Extending prior research based on global retrospective questionnaires, this study showed that depressive symptom severity was linked to greater average use of dampening and lower average use of self-focused positive rumination in daily life. Previous work on trait strategy use shows that participants with elevated depressive symptoms report greater use of dampening (Feldman et al., 2008; Nelis et al., 2015; Werner-Seidler et al., 2013), and there is some work revealing that depression is related to the infrequent use of positive rumination (e.g., Harding et al., 2014). However, the overwhelming majority of this work relies on laboratory-based studies that use global, retrospective measures of strategy use. Here, though, we document that similar patterns are observed in real-world settings. Further, the utilization of a 14-day EMA framework decreases the likelihood that the observed pattern of ER strategy use is confounded by reporting biases that commonly characterize global, retrospective reports (Shiffman et al., 2008; Tversky & Kahneman, 1973). The finding that depression was inversely associated with self-focused rumination but not emotion-focused positive rumination is consistent with prior research that
separates the two subtypes of positive rumination. Indeed, in the development of the RPA, the authors found that depressive symptoms were associated with dampening and self-focused positive rumination but not emotion-focused positive rumination (Feldman et al., 2008).

Interestingly, the results suggest that the relation between positive emotion and subsequent ER strategy use did not vary as a function of depressive symptoms. One could expect differential ER responses to positive emotion depending on depression levels. We hypothesized that higher levels of positive emotion would be associated with greater subsequent dampening among individuals with relatively elevated levels of depressive symptoms but not among individuals with low levels of depressive symptoms. Instead, the results indicate that the depressive symptom levels did not account for variation in how individuals respond to positive emotion with ER. The present data show that individuals with elevated depressive symptoms report greater overall use of dampening and less use of self-focused positive rumination regardless of the level of prior positive emotion. Stated another way, individuals with greater depressive symptoms were more likely to engage in dampening and less likely to engage in self-focused positive rumination than individuals with less depressive symptoms following low, medium, and high levels of positive emotion. Thus, depression-related ER differences do not depend on the extent to which one is experiencing positive emotion, but rather individuals with greater levels of depression are more likely to engage in maladaptive strategy use in response to any level of positive emotion.

Moreover, results from the study compliment and extend prior research on the relation between strategy use and positive emotion. As anticipated, greater use of dampening was associated with lower levels of momentary positive emotion. This finding is consistent with previous work showing that a dampening induction results in decreases in positive emotion (Burr et al., 2017) as well as a study showing that trait dampening was associated with lower levels of positive emotion in daily life (Li et al., 2017). Prior research on the relation between positive rumination and positive emotion is mixed. Positive rumination inductions do not yield increases in positive emotion above and beyond that generated by authors’ control condition (i.e., a 15-min walk); however, Li and colleagues (2017) found that trait positive rumination was associated with greater levels of positive emotion in daily life. Within the current study, greater engagement in both forms of positive rumination are associated with higher levels of momentary positive emotion. In fact, a notable strength of the current study is the comprehensive assessment of depression, strategy use, and positive emotion within the same sample and the implementation of multilevel models to examine dynamic relations between strategy use and positive emotion. Most studies on the link between depressive symptoms and ER strategy use do not also assess the relation between strategy use and positive emotion (e.g., Beblo et al., 2012; Feldman et al., 2008; Nelis et al., 2015; Werner-Seidler et al., 2013). Across two sets of models, we show that depression is associated with maladaptive strategy use (i.e., increased use of dampening and decreased use of self- and emotion-focused positive rumination) and that such strategy use is related to lower levels of momentary positive emotion. The integration of these findings provides support for the notion that depression-related differences in positive ER strategy use contribute to low levels of positive emotion putatively associated with depression.

Within the current sample, depression did not moderate the relation between positive ER strategy use and momentary positive emotion. This finding suggests that dampening and both forms of positive rumination relate to positive emotion similarly across all levels of depressive symptoms. Therefore, depression-related problems with positive ER may be specifically characterized by difficulties with habitual strategy use and not by deficits in the ability to effectively utilize these strategies. That is, individuals with elevated depressive symptoms may be as able to use self- and emotion-focused positive rumination to increase positive emotion; however, they use these strategies infrequently, and instead, they habitually engage in dampening responses to positive emotion. This pattern of results is consistent with difficulties in the regulation of negative emotion as they relate to depression. Indeed, in a recent review paper, Liu and Thompson (2017) highlighted that depression is more robustly associated with difficulties regarding the habitual use of ER strategies than with problems implementing a given strategy to down-regulate negative emotion.

The current study is not without limitations. First, the measurement of habitual ER relied on self-report measures of strategy use. Although the utilization of an EMA paradigm addresses many of the limitations of global, retrospective reports, the EMA model is still subject to limitations of self-report methods in general. In particular, it is important to note that self-reports of dampening and positive rumination require insight into one’s cognitive responses to emotion, and there is evidence showing that people’s estimates of their habitual use of cognitive ER strategies are not always associated with spontaneous strategy use (e.g., Egloff et al., 2006). Thus, an important direction for future work is the development and refinement of tools for assessing habitual ER, such as spontaneous ER sampling (Ehring et al., 2010). Second, the EMA questionnaire did not assess the events of one’s day, which may have important ramifications for emotional functioning. Daily life events were not assessed in the current study to limit the length of EMA questionnaires in the service of preventing participant burnout. Nevertheless, future work integrating reports of daily events, ER strategy use, and positive emotion would allow for researchers to examine the complex interactions between these constructs as they relate to depression. Third, the current study focused on depressive symptoms even though anhedonia has been shown to cut across multiple forms of psychopathology (Corral-Frias et al., 2015; Husain & Roiser, 2018). The focus on depression was driven by the central role that anhedonia plays within the disorder, comprising one of its two hallmark symptoms. That said, greater understanding of the relation between ER and positive emotion across psychological difficulties holds promise for refining unified treatments for emotional difficulty in general. Finally, it is important to note that the within-subjects reliability coefficients of the RPA subscales were lower compared to the between-subjects reliability coefficients, and this was especially the case with regard to the dampening subscale. Although the three dampening items all entail negative cognitions in response to positive emotion, such cognitions may stem from related but distinct underlying processes such as worry (thinking about things that could go wrong), pessimism (thinking, “My streak of luck is going to end soon”), and negative self-esteem (thinking, “I don’t deserve to feel good”). Greater variability in these underlying processes may explain the
relatively low within-subjects reliability. To understand the psychometric properties of this subscale and to elucidate differences between within- and between-subjects coefficients, we recommend that prior research assessing strategy use over time publish these statistics.

Better understanding of ER difficulties as they relate to depression has important implications for its treatment. The current gold-standard psychotherapy for depression is individual cognitive–behavioral therapy, with an emphasis on behavioral activation (Cuijpers et al., 2007). Behavioral activation focuses on increasing one’s engagement in activities that elicit positive emotion. However, the current data imply that it is also important to directly address how individuals respond to positive emotion once it has been evoked. In fact, recent research has shown that engagement in dampening and positive rumination has important implications for emotional responding to positive activity scheduling, a core premise of behavioral activation. Indeed, Burr and colleagues (2017) found that greater engagement in dampening during scheduled positive events is associated with higher levels of negative emotion and lower levels of positive emotion. Similar findings are seen in studies on the moderating role that dampening and positive rumination play in the relation between positive events and depressive symptoms over time. For example, Li et al. (2017) reported that greater dampening mitigates the lessening of depressive symptoms following positive events among individuals with elevated depressive symptoms. Thus, the current results, in conjunction with recent research, highlight the risk for ER difficulties undermining existing aspects of gold-standard treatments for depression. As such, these findings suggest that treatments would benefit from directly targeting difficulties with the regulation of positive emotion.

Finally, the present findings reveal important directions for future research. The current study shows that dysfunction in the habitual use of positive ER strategies contributes to low levels of positive emotion. It remains unclear, however, as to why individuals with elevated depressive symptoms use certain strategies over others. Thus, a vital next step is to identify factors that guide the habitual use of positive ER strategies. Instrumental models of ER (Tamir, 2009, 2016) highlight one important factor (i.e., emotion preferences) that may guide strategy use. These models posit that people use strategies that are congruent with their emotion preferences (i.e., desired emotion states). Importantly, instrumental models account for the notion that people may not always strive to increase positive emotion and, instead, may down-regulate positive emotion if it is not preferred. As such, these models may provide a promising structure for future research aimed at investigating the relation between emotion preferences and habitual strategy use as they relate to depression given that depressive symptoms are associated with a propensity to down-regulate positive emotion. Identifying factors associated with maladaptive strategy use would highlight additional targets for treatments aimed at improving the regulation of positive emotion.

References


1 Supplemental Materials 4 details results of the analyses that examined potential differential relations between the dampening items and momentary positive affect. All three dampening items were related to concurrent positive emotions, and positive emotions predicted subsequent dampening behaviors (in particular, Item 1 and Item 2).


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