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Effects of Emotion Regulation Strategy Use in Response to Stressors on PTSD Symptoms: An Ecological Momentary Assessment Study

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Abstract

Background—Although a burgeoning line of research identifies emotion regulation difficulties as a potential maintenance factor for posttraumatic stress disorder (PTSD), little is known in regard to what emotion regulation strategies individuals with PTSD use in their daily lives, their predictors, and their consequences on later PTSD symptoms.

Method—The current study utilized ecological momentary assessment (EMA) design to explore prospective relationships between maladaptive and adaptive emotion regulation strategy use and PTSD symptoms in participants with PTSD ($N = 30$). Participants completed 4 EMAs per day over 8 days, assessing stressors, emotional response, and emotion regulation strategy use.

Results—Individuals with PTSD most commonly used avoidance as an emotion regulation strategy. Multilevel modeling indicated that baseline PTSD symptoms predicted maladaptive

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Contributors

NAS developed the study idea, collected data, and wrote the majority of the manuscript. JWB wrote the method. KC assisted with the introduction and discussion. NBS reviewed all drafts of the manuscript. All authors have approved the final article.

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emotion regulation strategy use. After covarying for morning PTSD symptoms, maladaptive emotion regulation prospectively predicted increased PTSD symptoms later in the day. Adaptive emotion regulation strategies did not uniquely predict later PTSD symptoms.

Conclusion—In line with conceptualizations of difficulties in emotion regulation as a transdiagnostic maintenance factor in PTSD, findings indicate that maladaptive emotion regulation strategies in response to stressors exacerbate PTSD symptoms. The use of adaptive emotion regulation strategies had no positive or negative impact on subsequent PTSD symptoms.

Limitations—Future studies should utilize longer-term prospective designs.

Keywords

posttraumatic stress; ecological momentary assessment; emotion regulation

Traumatic event exposure is prevalent in the general population, with up to 90% of individuals experiencing a trauma in their lifetime (Kilpatrick et al., 2013; Resnick et al., 1993). Individuals exposed to trauma often experience posttraumatic stress disorder (PTSD) symptoms in the immediate aftermath of trauma exposure, which can take the form of re-experiencing the event, increased anxiety, and feeling watchful or “on guard” (Kilpatrick and Resnick, 1993). For most, these symptoms will subside within a few weeks to months after trauma exposure. However, for approximately 6.8% of individuals, these symptoms become chronic and lead to significant distress and impairment, leading to a diagnosis of PTSD (Kessler et al., 1995). PTSD is characterized by four symptom clusters: re-experiencing the event in nightmares, flashbacks, and unwanted intrusive memories, avoidance of reminders of the event, negative alterations in cognition and mood (e.g., inability to experience positive emotions, blaming oneself for the event, etc.), and alterations in arousal (e.g., difficulties sleeping, hypervigilance). Considering the prevalence of and impairment associated with PTSD, it is important to identify modifiable factors that play a role in the development and maintenance of PTSD symptoms.

One promising risk factor receiving growing attention within the PTSD literature is difficulties in emotion regulation. There are various definitions of emotion regulation. The ones primarily examined within the PTSD literature include Gross’s model of emotion regulation that focuses on two key potential emotion regulation strategies (i.e., cognitive re-appraisal and suppression), and Gratz and Roemer’s model which focuses on a variety of facets relating to how one responds to one’s emotions. However, we will consider that, at its core, emotion regulation is defined as an attempt, whether implicit or explicit, to modify one’s emotional response (Werner and Gross, 2009), whereas emotion regulation difficulties are essentially problems with responding to one’s emotions, including the inability to successfully regulate one’s emotions.

Because psychopathology such as PTSD is characterized by persistent negative emotions, efforts to describe emotion regulation in PTSD often focus on individuals’ attempts to reduce negative emotions (as opposed to focusing on regulation of positive emotions; Ehring and Quack, 2010; Weiss et al., 2012; Werner and Gross, 2009). A growing body of research has examined the role of emotion regulation in this fashion across various forms of

psychopathology, including substance use, eating, mood, and anxiety disorders (see Aldao et al., 2010 for a review). Emotion regulation difficulties are believed to confer risk for psychopathology by leading to increased physiological arousal and distress in response to stressors, as well as maladaptive coping behaviors, such as avoidance, that paradoxically increase symptoms over time (Cisler et al., 2010; Gross and Levenson, 1993). Within PTSD, for example, emotion regulation difficulties may increase one's tendency to avoid trauma-related stimuli to avoid negative emotional responses that are perceived as difficult to tolerate or regulate.

Several studies have evaluated the idea that emotion regulation problems increase PTSD symptoms. Gratz and Roemer's model (2004) of emotion regulation difficulties includes the inability to distinguish, tolerate, and regulate emotions and to persist toward a goal, including inhibiting impulsive responses when emotionally distressed. Within this model, it is thought that these difficulties with emotion regulation may motivate individuals to rely on avoidant coping strategies to regulate their PTSD symptoms. For example, an individual who perceives themselves as lacking access to effective emotion regulation strategies may be more motivated to avoid trauma reminders that could cause increase negative emotions. Alternatively, individuals with difficulties inhibiting impulses may rely on substance use to cope with emotions related to posttraumatic stress. These avoidance-oriented coping strategies would lead to increases in PTSD symptoms as the individual never learns corrective information (e.g., they actually can tolerate the negative emotions associated with their trauma; Foa et al., 2007; Tull et al., 2007). Emotion regulation problems have been found to be cross-sectionally associated with increased PTSD symptoms in several studies in various samples (Fairholme et al., 2013; O'Bryan et al., 2015; Short et al., 2016; Tull et al., 2007). Finally, initial research suggests a prospective association between emotion regulation difficulties and PTSD symptoms (Bardeen et al., 2013).

In terms of Gross's model of emotion regulation, it is thought that using cognitive reappraisal is an adaptive emotion regulation strategy as it enables one to change one's emotional response prior to the complete activation of one's emotional response. On the other hand, expressive suppression is thought to be maladaptive as it requires the suppression of a fully developed emotional response (Gross and Levenson, 1993). Cross-sectional research suggests that individuals with higher levels of PTSD symptoms tend to use more expressive suppression, a maladaptive emotion regulation strategy, and less cognitive reappraisal, thought to be an adaptive strategy (Boden et al., 2012; Moore et al., 2008; Werner and Gross, 2009). Theoretically, individuals with PTSD may rely on suppressing one's emotional responses, resulting in a paradoxical rebound in negative emotional response, and thus maintaining PTSD symptoms.

Despite research linking increased frequency of expressive suppression as a maladaptive emotion regulation strategy use to elevated PTSD symptoms (e.g., Moore et al., 2008), it is unclear how often individuals with PTSD utilize other maladaptive emotion regulation strategies. Examples of other maladaptive strategies include thought suppression (Beck et al., 2006), rumination (Michael et al., 2007), impulsive behaviors (Weiss et al., 2012), and avoidance. Moreover, very little research has examined whether individuals with PTSD also use adaptive emotion regulation strategies, and whether that may lead to improvements in

PTSD symptoms over time. Studies have examined cognitive reappraisal as a potential factor in improving PTSD symptoms (Boden et al., 2012; Resick and Schnicke, 1992), but few studies have assessed other adaptive strategies, such as problem solving (Nezu and Carnevale, 1987) or acceptance (Orsillo and Batten, 2005). Better understanding the strategies individuals with PTSD use would be useful in the development of interventions to target PTSD.

Furthermore, little research to our knowledge has examined what factors prompt individuals with PTSD to utilize maladaptive emotion regulation strategies rather than adaptive ones. For example, PTSD symptoms themselves may lead to increased use of maladaptive emotion regulation strategies (Bardeen et al., 2013), leading to a cycle that ultimately exacerbates PTSD symptoms. Additionally, although numerous extant studies have linked emotion regulation difficulties to PTSD symptoms, it remains unclear as to whether emotion regulation problems precede PTSD symptoms. As previously discussed, it is possible that emotion regulation difficulties are a consequence of PTSD symptoms (e.g., Bonn-Miller et al., 2011). Considering this, it is imperative for research to examine whether emotion regulation problems temporally precede increased PTSD symptoms, and thus should be examined as a candidate causal risk factor for PTSD.

To examine the frequency of maladaptive and emotion regulation strategy use in PTSD, their predictors and consequences, the current study included a clinical sample of individuals diagnosed with PTSD who participated in ecological momentary assessment (EMA; Shiffman et al., 2008). EMA research allows the collection of data regarding an individual's current experience in real time, in the individual's natural environment, thus enhancing external validity and allowing the examination of how constructs change together over time. In the current study, individuals were assessed 4 times per day over 8 days, and self-reported PTSD symptoms, whether they experienced a stressor, associated distress, and emotion regulation strategies used to alleviate their distress. Hypotheses of the current study were as follows. First, as an exploratory aim, we determined the frequency of various emotion regulation strategy use in the daily lives of individuals with PTSD. Second, we hypothesized that higher levels of PTSD would predict increased maladaptive emotion regulation strategies and decreased adaptive emotion regulation strategies following a stressor during the EMA period. Third, we hypothesized that using maladaptive emotion regulation strategies during the EMA period will predict increased later PTSD symptoms later that day, and that that using adaptive emotion regulation strategies will predict decreased later PTSD symptoms, after covarying for morning PTSD symptoms.

Method

Participants

Participants ($N = 30$) were recruited from the local community ($n = 24$, 77.4%), and the university's undergraduate research pool ($n = 6$, 19.4%). Inclusion criteria required participants be at least 18 years of age, have a current diagnosis of PTSD as determined via clinical interview, and own a mobile phone capable of accessing the internet. Exclusion criteria included the present diagnosis of a psychotic disorder in the absence of stable psychiatric medication, and diagnosis of a severe substance use disorder according to

DSM-5. Regarding screening and enrollment into the study, 22 undergraduates were screened and 6 met criteria and were enrolled (ineligible participants did not have PTSD), while 33 community participants were screened and 24 were enrolled (ineligible participants did not have PTSD [$n = 8$], or did not own a smart phone [$n = 1$]). Participants ranged in age from 18 to 60 ($M = 38.03$, $SD = 15.14$), and primarily identified as female (61.3%). The majority of participants identified their race as White (64.5%), followed by African-American (29%) and Alaskan Native/American Indian (3.2%). Student participants were significantly younger ($t(28) = 4.53$, $p < .001$), but did not differ in terms of gender or PTSD symptom severity ($ps > .149$).

As noted, all participants met current criteria for PTSD diagnosis. With respect to most distressing trauma, per self-report on the PDS, distribution of index events were as follows: sexual assault by someone you know (33.3%), non-sexual assault by someone you know (13.3%), other (e.g., witnessing a death, mass grave sites, 13.3%), serious accident (10.0%), sexual assault by a stranger (10.0%), combat (6.7%), imprisonment (6.7%), non-sexual assault by a stranger (3.3%), while one participant did not select a most bothersome event (3.3%). Regarding psychiatric comorbidities, 93.3% of the sample met criteria for at least one other diagnosis, including 80% for a comorbid anxiety disorder, 73.3% for a mood disorder, 26.7% for an obsessive compulsive or related disorder, 13.3% for a substance use disorder, and 6.7% for an eating disorder. Note that because most individuals had more than one comorbid diagnosis, the total of these percentages exceeds 100%.

Procedure

All procedures were first approved by the university's institutional review board. Participants were recruited via email through advertisements in local print and broadcast media among the community, or the university's undergraduate research pool. Interested parties were screened via phone, and those deemed eligible were scheduled for a baseline appointment.

Upon presenting for the baseline appointment, all participants provided written informed consent. Participants then completed the clinical interview and self-report measures. Doctoral students or trained research assistants collected information regarding participants' habitual sleep and wake times, which were used to create a quasi-random text message schedule for their personalized EMA period. Participants were then provided instructions for completing the EMAs, and completed a practice link on the individual's mobile phone to ensure that they could capably respond to the EMA surveys. Participants were then provided the lab phone number, encouraged to call with any subsequent questions, and dismissed.

Over the following eight days of the EMA period, participants received four text messages per day, based on results from a power analysis unrelated to the current study (Short et al., in press). Text messages were sent automatically through Google Voice on an evenly spaced, quasi-random schedule in accord with their self-reported sleep schedule. Thus, each participant's assessment schedule varied. Participants accessed a link to Qualtrics' mobile platform to complete the surveys, which took about 5 minutes to complete. Participants received one reminder text if their assessment had not been completed within 30 minutes. They were allowed an hour in total to complete the assessment. Participants were also

contacted via phone call if they missed two full days of EMAs, to determine whether there were technical problems.

Following the EMA period, participants received monetary (\$25) and/or course credit compensation, regardless of how many EMA assessments they completed. As established during the informed consent procedure, participants who completed more than 75% of the EMA assessments (73.9% of the study sample) were awarded a \$10 bonus.

Measures

Baseline

Structured Clinical Interview for DSM-5 (SCID): The SCID is a well-validated semi-structured clinical interview designed to assess the presence of psychiatric conditions (First et al., 2015). The SCID was administered to determine PTSD diagnosis, and thus study eligibility, as well as the presence of comorbid diagnoses. SCIDs were administered by highly trained clinical psychology doctoral students, and subsequently reviewed by a licensed clinical psychologist. Agreement between interviewers for a random sample of SCIDs administered by our laboratory resulted in high inter-rater agreement (i.e., over 80% agreement, $k = .86$, $n = 20$; Schmidt et al., 2016).

PTSD Checklist (PCL-5): The PCL-5 is a well-validated self-report measure of distress related to each of the 20 DSM-5 PTSD symptoms (Weathers et al., 1993). Participants were asked to indicate how much they have been bothered by each symptom during the past month on a 5-point Likert-style scale from 0 (*not at all*) to 5 (*extremely*). The PCL-5 has demonstrated excellent psychometric properties among various samples (Blanchard et al., 1996; Wilkins et al., 2011). In the present sample, scores on the PCL-5 demonstrated excellent internal consistency ($\alpha = .90$).

EMA

Stressors: Stressors were assessed via a single dichotomous (i.e., yes/no) question, in which participants responded to whether “anything upsetting or stressful” happened since the last assessment. If yes, participants were prompted to answer further questions regarding the event, including their emotional and physiological reactions. Please see the appendix for the full measure.

Emotion Regulation: In conjunction with the assessment of stressors, individuals provided information regarding emotion regulation. Participants who endorsed a stressor that was at least “moderately” upsetting were prompted to respond to possible emotion regulation strategies they used. Participants were shown seven statements about the use of emotion regulation strategies, and asked to indicate (yes/no) whether they employed that strategy. Among these strategies were cognitive re-appraisal, acceptance, problem solving, thought suppression, rumination, impulsive behaviors, and avoidance. Cognitive re-appraisal, acceptance, and problem solving were considered adaptive emotion regulation strategies, while thought suppression, rumination, impulsive behaviors, and avoidance were considered maladaptive (Aldao et al., 2010; Tan et al., 2012; Werner and Gross, 2009). Adaptive and maladaptive strategies were summed separately to create scores for adaptive and

maladaptive emotion regulation use. Please see the appendix for the full measure, which was modeled from a previous EMA study on emotion regulation (Tan et al., 2012).

PTSD symptoms: PTSD symptoms were assessed at each time point with 10 items from the PCL-5. Items were chosen based on the strength of their loadings onto their respective symptom clusters in factor analytic research (King et al., 1998), resulting in 2–3 items from each of the four DSM-5 PTSD symptom clusters included in this assessment. The chosen items therefore represented symptoms related to: intrusions; very upset when reminded of trauma; physical reactions when reminded of the trauma; avoiding internal reminders; avoiding external reminders; feeling distant or cut off from others; anhedonia; difficulty concentrating; watchfulness; and being easily startled. Consistent with prior EMA research (Possemato et al., 2012), PCL-5 instructions were modified to direct participants to rate the extent to which they had experienced each symptom since their last assessment. For more details on the PTSD measure, see Short et al. (in press). Internal consistencies for abbreviated PCL-5 scores were good to excellent in the present study (session-level $\alpha = .80$, day-level $\alpha = .91$, person-level $\alpha = .93$).

Data Analytic Plan: Multilevel modeling was used due to its ability to take into account nested data and missing data better than classical analyses used to analyze EMA studies (Schwartz and Stone, 1998). Analyses were conducted using MPlus Version 7.4 with full information maximum likelihood estimation using the robust estimator (Muthén and Muthén, 1998–2012). The models consisted of 3 levels with random effects: sessions nested within days nested within individuals. The models were estimated using an unstructured covariance matrix. Throughout the results section, unstandardized estimates are reported, consistent with current recommendations (Hox, 2010). Chi-square and related model fit statistics are not available for random effects multilevel models in MPlus, therefore they are not reported. However, it is difficult to compare model fit across multilevel models given the variance partitioned at each level differs as variables are added, making these indexes less useful.

For models of the effects of emotion regulation strategies on PTSD symptoms, the dependent variable was PTSD symptoms at daily sessions 3–4 (i.e., afternoon and evening; see Figure 1), with variance partitioned at the session- and day-level. Independent day-level variables were adaptive or maladaptive emotion regulation strategy use at sessions 2 and 3 (midmorning and afternoon), and, as a covariate, morning PTSD symptoms (see Figure 1). As such, we examined the contribution of emotion regulation to later day PTSD symptoms, after accounting for that morning's PTSD symptoms. For models predicting the use of emotion regulation strategies, adaptive and maladaptive strategy use during the EMA were dependent variables in separate models. Independent baseline variables (i.e., PCL-C) was the predictor.

Results

Preliminary Analyses

Prior to running analyses, data were screened to confirm accurate data entry, assess for outliers, and evaluate skewness and kurtosis. Evaluation of data ranges confirmed that

responses were entered correctly. We also evaluated the data for outliers and analyses indicated there were none that could potentially influence the models. Regarding missing data, 80.0% of the possible EMAs were completed by participants. No participants were excluded due to missing data as multilevel modeling uses full information maximum likelihood to include all participants regardless of missing data presence and because dropping participants with missing data can introduce bias (Schafer and Graham, 2002).

We then examined descriptive statistics and correlations for all variables of interest at baseline. PCL-5 means ($M = 39.28$, $SD = 12.44$) were higher than the recommended clinical cutoff of 33 (U. S. Department of Veterans Affairs, 2016).

We also examined key EMA variables' means, standard deviations, and temporal patterning (Table 1). There was a significant effect of day such that PTSD symptoms decreased as the EMA period went on ($B = -.05$, $SE = .02$, $p = .001$). However, there was no significant effect of time of day on PTSD symptoms ($B = .46$, $SE = .56$, $p = .413$). Stressors were reported in 13.9% of the 560 assessments. There was a significant effect of ID such that some participants reported more stressors than others ($F(1, 29) = 3.80$, $p < .001$). However, there was no effect of day ($B = -.001$, $SE = .001$, $p = .230$) or time of day ($B = .24$, $SE = 1.72$, $p = .891$) on the experience of stressors. Stressors were both related to PTSD symptoms (e.g., "I ran into the guy who raped me," "Always dealing with the VA or veterans that have their own problems," and "Topic came up in conversation and reminded me") and unrelated (e.g., "I had to take my dog to the vet for surgery," "Worries about health and finances," and "Relationship issues"). Stressors occurred an average of 93.43 minutes before the EMA assessment ($SD = 78.88$). Participants reported being "quite a bit" upset by the event (about 4 on a 1–5 scale), on average. Most participants (84.4%) reported they felt physical symptoms during the stressor (e.g., heart racing, shortness of breath), while about a third reporting feeling dissociation (e.g., "I felt like things around me weren't real, or like I was out of my body") associated with the stressor (35.5%).

In assessments where participants reported a qualifying stressor (i.e., endorsed a stressor that was rated as upsetting), participants reported using the following emotion regulation strategies: avoidance (75.0%), acceptance (71.8%), problem solving (62.5%), rumination (62.5%), suppression (50.0%), cognitive re-appraisal (40.6%), and impulsive behavior (28.2%). Day did not significantly predict maladaptive ($B = -.01$, $SE = .01$, $p = .117$) or adaptive ($B = -.01$, $SE = .003$, $p = .109$) emotion regulation strategy use. Time of day also did not significantly predict maladaptive ($B = -.14$, $SE = .30$, $p = .639$) or adaptive ($B = .04$, $SE = .26$, $p = .888$) emotion regulation strategy use. Type of stressor (i.e., trauma-related or not) did not significantly predict the amount of maladaptive ($t = 1.86$, $p = .068$) or adaptive ($t = -.33$, $p = .742$) strategies used.

Primary Analyses

Predictors of Emotion Regulation Strategy Use—First, we examined predictors of maladaptive emotion regulation use in one model including baseline PTSD symptoms. Day did not significantly predict maladaptive emotion regulation strategy use ($B = -.01$, $SE = .01$, $p = .116$, 95% CI $[-.02, .002]$). There was a significant association between baseline

PTSD symptom severity and maladaptive emotion regulation strategies ($B = .12$, $SE = .03$, $p < .001$, 95% CI [.03, .17]).

Second, we examined predictors of adaptive emotion regulation use in a similar model. Day did not significantly predict adaptive emotion regulation strategy use ($B = -.01$, $SE = .003$, $p = .109$, 95% CI [-.01, .001]). Baseline PTSD symptoms ($B = .04$, $SE = .03$, $p = .081$, 95% CI [-.01, .09]) did not significantly predicted later adaptive emotion regulation strategies.

Associations between Emotion Regulation Strategies and Later PTSD

Symptoms—We conducted one multilevel model including morning PTSD symptoms and both maladaptive and adaptive emotion regulation strategies as predictors of later PTSD symptoms. Morning PTSD symptoms ($B = .25$, $SE = .49$, $p = .026$, 95% CI [.03, .46]) and maladaptive emotion regulation strategies ($B = 1.36$, $SE = .57$, $p = .019$, 95% CI [.23, 2.49]) predicted later PTSD symptoms; however, adaptive emotion regulation strategies did not ($B = .12$, $SE = .49$, $p = .805$, 95% CI [-.84, 1.08]).

Discussion

The current study expanded upon research on emotion regulation difficulties and PTSD by being the first study to use an EMA design to study specific emotion regulation strategy use in PTSD. Results revealed that, after accounting for morning PTSD symptoms, using maladaptive emotion regulation strategies in the mid-morning and afternoon were associated with increased PTSD symptoms later in the day. In other words, the use of maladaptive emotion regulation strategies temporally preceded later increases in PTSD symptoms. These findings are in line with various studies suggesting maladaptive emotion regulation strategy use is linked with increased PTSD symptoms (e.g., Moore et al., 2008). However, we expanded upon prior research by examining several common maladaptive emotion regulation strategies: avoidance, thought suppression, rumination, and impulsive behaviors, and by indicating that the use of these strategies temporally precedes increases in PTSD symptoms. In addition, we were able to identify that maladaptive emotion regulation strategies influence transient changes in PTSD symptoms, which cannot be assessed using typical self-report measures of PTSD. In sum, these findings provide further evidence for the notion that the use of maladaptive emotion regulation strategies is a maintaining factor in PTSD symptoms. Results are also consistent with the notion that attempting to reduce negative emotions using certain strategies actually exacerbates them (Aldao et al., 2010).

Results also revealed that baseline PTSD symptoms significantly predicted maladaptive emotion regulation strategy use during the EMA period. This finding supports the idea that PTSD symptoms and emotion regulation difficulties may share a bidirectional relationship (Bardeen et al., 2013), potentially resulting in a vicious cycle of escalating PTSD symptoms. Future research should examine whether state PTSD symptoms predict later state emotion regulation difficulties. Baseline PTSD symptoms did not significantly predicted adaptive emotion regulation strategy use during the EMA period. Along with other findings in the current study, it is possible that adaptive strategy use is not as relevant in psychopathology as the use of maladaptive strategies.

In addition to examining predictors and consequences of various emotion regulation strategies, we also analyzed the frequency of use of different types of emotion regulation strategies. Consistent with the notion that avoidance is at the core of PTSD's pathology, avoidance was the most commonly used emotion regulation strategy (Foa et al., 2007). Indeed, avoidance was most commonly used across both trauma-related stressors and stressors not related to trauma, indicating that individuals with PTSD may use avoidance to decrease negative emotions regardless of trauma relevance. Somewhat surprisingly, two adaptive strategies, acceptance and problem solving were the next most common emotion regulation strategies to be used. Because emotion regulation research within PTSD often focuses on maladaptive strategies rather than adaptive ones, it is possible that researchers underestimate how often individuals with PTSD actually use adaptive strategies. Next, consistent with prior research, rumination and thought suppression were also common among individuals with PTSD (Beck et al., 2006; Michael et al., 2007). Finally, cognitive reappraisal and impulsive behaviors were the least common strategies. This could speak to the value of teaching individuals with PTSD to use cognitive reappraisal, as it may not be frequently used by this population (Resick and Schnicke, 1992). However, the lack of impulsive behaviors to reduce negative emotions was somewhat unexpected, as impulse control problems and impulsive behaviors like substance use and nonsuicidal self-injury are fairly common in PTSD (Weiss et al., 2012). This finding may be in part due to the nature of our sample, which had relatively low levels of alcohol or substance use.

Inconsistent with hypothesis, the use of adaptive strategies was not significantly associated with later PTSD symptoms. One would expect that the use of adaptive strategies would be associated with improved PTSD symptoms later on (Boden et al., 2012). However, there are several reasons why adaptive strategies may have not been associated with later PTSD symptoms. First, the perceived need to regulate emotions at all might be indicative of emotion regulation problems, regardless of whether one chooses to use adaptive or maladaptive strategies. This "need" to regulate emotions could be indicative of intolerance of negative emotions, an etiological factor in PTSD (Marshall-Berenz et al., 2010). Second, it is possible that the use of maladaptive strategies "cancels out" the effects of any adaptive ones. Third, it is also plausible that problem solving and acceptance may not *always* be adaptive strategies. For example, it is possible that individuals with PTSD choose to accept situations they could actually work to change. Our results combine to underscore the notion that understanding adaptive emotion regulation strategies in the context of psychopathology requires further research, and raise the possibility that adaptive strategies may not always be helpful in improving PTSD symptoms. Fourth, we measured the effect of strategy use on PTSD symptoms within mere hours. It is possible that individuals must regularly use adaptive strategies on a longer-term (weeks or months) basis to experience improvements in PTSD symptoms.

Results of the current study have clinical implications. First, our findings suggest it may be more important clinically to focus on decreasing maladaptive strategies, rather than increasing adaptive strategies. Adding adaptive strategies to clients' repertoires of potential emotion regulation strategies could be one way to assist in decreasing maladaptive ones by replacing them. However, our results suggest it would still be important to assess maladaptive strategies and ensure they are decreasing over time (rather than just adding

adaptive strategies in conjunction with maladaptive ones). In this vein, our results support the use of treatments such as Prolonged Exposure that reduce the use of the most commonly used maladaptive emotion regulation strategy in this study, avoidance (Foa et al., 2007). In addition, our results highlight the importance of accepting negative emotions rather than attempting to control, suppress, or avoid them. As such, other treatment modalities, such as Acceptance and Commitment Therapy or Dialectical Behavioral Therapy (Hayes et al., 2006; Linehan et al., 2006), that aim to assist individuals in accepting negative emotion, are also supported by the current results. However, more research is needed on the effectiveness of these treatments and whether they improve emotion regulation among individuals with PTSD.

Findings of this investigation must be considered in light of limitations and directions of future research. First, individuals in our sample were already diagnosed with PTSD. Thus, we cannot establish that maladaptive emotion regulation strategies prospectively predict PTSD; however, our results suggest they may be a maintaining factor. Future research should examine whether maladaptive emotion regulation strategy use prospectively predicts the development of PTSD (e.g., Bardeen et al., 2013). Second, we did not assess all possible emotion regulation strategies. We selected the most commonly used and studied strategies to reduce participant burden and replicated the strategies from a prior EMA study (Tan et al., 2012). However, it is possible that participants also used strategies that were not assessed (e.g., distraction, behavioral activation, seeking social support, “venting,” etc.), and that these could have impacts on PTSD symptoms as well. Future research should seek to understand which emotion regulation strategies are most important to assess, and most relevant to PTSD (e.g., Sullivan et al., in press). Third, due to power issues, we could not focus exclusively on trauma-related stressors. As such, not all stressors were directly applicable to PTSD. However, our results indicated that the use of adaptive vs. maladaptive strategies did not differ based on the type of stressor (trauma-related or not). Furthermore, it is plausible that unrelated life stressors and the ways people manage them would also affect PTSD symptoms (Nezu and Carnevale, 1987). Yet, future research could benefit from the ability to only assess trauma-related stressors as these are the most theoretically tied to exacerbation of PTSD symptoms.

Fourth, although the use of EMA is a strength of the study, we only followed participants over 8 days. It is unclear whether these findings would generalize to longer term increases in PTSD. Fifth, our study design assumes individuals can accurately report on emotion regulation strategies, which may not always be the case. Future research should coach participants on the meaning of each strategy prior to beginning the EMA period. Sixth, our sample size was relatively small, and the current results should be replicated in a larger sample. Seventh, we only included individuals with PTSD. Having a non-PTSD control group could determine whether these results are unique to individuals with PTSD or more broadly applicable. Eighth, although we used the DSM-5 symptom structure of PTSD to determine items assessing PTSD symptoms during the EMA period, this does not correspond to some of the factor structures of PTSD that have been identified (Armour et al., 2016). Future research may benefit from assessing all symptoms of PTSD. Eighth, categorizing emotion regulation strategies as “adaptive” or “maladaptive” can be misleading as emotion regulation strategies are context-dependent (e.g., it may be adaptive to avoid a

situation if it is actually dangerous). However, we needed to limit participant burden and thus did not ask that level of detail regarding the stressor experienced and how emotion regulation strategies were used. As such, future research may query in greater detail how each strategy was used to determine its adaptiveness.

Despite these limitations, the current study expands upon research identifying emotion regulation difficulties as an etiological factor in PTSD. Our results indicate that individuals with PTSD use a variety of emotion regulation strategies, but tend to rely most on avoidance. Maladaptive emotion regulation strategies exacerbate PTSD symptoms over time, so future research should focus on how to best reduce the use of these strategies to improve clinical outcomes for individuals with PTSD.

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Appendix

Stressors, Emotions, and Emotion Regulation EMA Questionnaire

1. Did anything upsetting or stressful happen since your last assessment? YES/NO

If YES, describe briefly _____

If YES, how long ago did this event occur? _____ mins

If YES, how upset were you by this event?

	Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely
UPSET	1	2	3	4	5

If UPSET > 3:

Please rate if you felt the following during the situation.

- a. I felt physical symptoms (e.g., heart racing, feeling short of breath, feeling hot or sweaty). YES/NO

- b.** I felt like things around me weren't real, like I was out of my body, or like I was watching myself as an outside observer. YES/NO

When you became upset, did you do any of the following?

- a.** I thought about it in a different way. YES/NO
- b.** I tried not to think about it. YES/NO
- c.** I tried to accept that this is the way things are. YES/NO
- d.** I couldn't stop thinking about it. YES/NO
- e.** I tried to think about a way to fix the problem. YES/NO
- f.** I kept my emotions to myself. YES/NO
- g.** I did something impulsive to make me feel better (e.g., using alcohol or drugs). YES/NO
- h.** I went out of my way to avoid thoughts, situations, or activities that would make me upset again. YES/NO

Highlights

- Patients with PTSD reported on use of emotion regulation strategies in an EMA study
- Avoidance was commonly used
- Maladaptive strategy use predicted increases in later PTSD symptoms
- Adaptive strategy use had no impact on later PTSD symptoms

Figure 1.
Depiction of Assessment Schedule.
Note. Days 3–8 not pictured.

Table 1

	PTSD Symptoms	Qualifying Stressor	Maladaptive Strategy Use	Adaptive Strategy Use
	M (SD)	M (SD)	M (SD)	M (SD)
Day 1	-	.40 (.49)	2.67 (1.05)	1.60 (.91)
Time 1	27.80 (7.38)	-	-	-
Time 2	25.16 (9.42)	-	-	-
Time 3	26.07 (9.66)	-	-	-
Time 4	25.78 (9.20)	-	-	-
Day 2	-	.20 (.41)	1.33 (1.03)	1.33 (1.03)
Time 1	23.39 (9.25)	-	-	-
Time 2	23.37 (8.98)	-	-	-
Time 3	24.30 (9.25)	-	-	-
Time 4	23.23 (9.23)	-	-	-
Day 3	-	.22 (.42)	2.00 (1.10)	2.17 (.75)
Time 1	23.92 (10.65)	-	-	-
Time 2	24.12 (9.48)	-	-	-
Time 3	23.88 (9.31)	-	-	-
Time 4	24.95 (8.81)	-	-	-
Day 4	-	.05 (.21)	3.00 (--) [*]	3.00 (--) [*]
Time 1	23.29 (10.05)	-	-	-
Time 2	22.95 (10.40)	-	-	-
Time 3	23.46 (9.05)	-	-	-
Time 4	27.13 (11.84)	-	-	-
Day 5	-	.19 (.40)	2.00 (.87)	1.33 (1.11)
Time 1	21.61 (8.42)	-	-	-
Time 2	22.83 (8.39)	-	-	-
Time 3	21.78 (8.46)	-	-	-
Time 4	25.05 (9.39)	-	-	-
Day 6	-	.16 (.37)	2.33 (1.03)	1.50 (1.05)
Time 1	22.79 (8.77)	-	-	-
Time 2	23.48 (9.12)	-	-	-
Time 3	25.08 (8.28)	-	-	-
Time 4	24.18 (9.28)	-	-	-
Day 7	-	.15 (.36)	1.60 (1.14)	1.20 (1.10)
Time 1	23.44 (10.48)	-	-	-
Time 2	23.75 (9.91)	-	-	-
Time 3	24.79 (9.20)	-	-	-
Time 4	24.23 (8.23)	-	-	-
Day 8	-	.18 (.39)	2.80 (1.10)	1.40 (.89)
Time 1	25.24 (8.40)	-	-	-
Time 2	23.13 (9.23)	-	-	-
Time 3	23.77 (7.87)	-	-	-

	PTSD Symptoms	Qualifying Stressor	Maladaptive Strategy Use	Adaptive Strategy Use
	M (SD)	M (SD)	M (SD)	M (SD)
Time 4	23.70 (9.52)	-	-	-

Descriptive statistics for Ecological Momentary Assessment variables

Note.

* = only one qualifying stressor was reported for that day; thus standard deviation is unavailable.