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BRIEF REPORTS

Further Examination of the Exposure Model Underlying the Efficacy of Written Emotional Disclosure

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In the current study, the authors examined the effects of systematically varying the writing instructions for the written emotional disclosure procedure. College undergraduates with a trauma history and at least moderate posttraumatic stress symptoms were asked to write about (a) the same traumatic experience, (b) different traumatic experiences, or (c) nontraumatic everyday events across 3 written disclosure sessions. Results show that participants who wrote about the same traumatic experience reported significant reductions in psychological and physical symptoms at follow-up assessments compared with other participants. These findings suggest that written emotional disclosure may be most effective when individuals are instructed to write about the same traumatic or stressful event at each writing session, a finding consistent with exposure-based treatments.

Keywords: emotion, written disclosure, salivary cortisol, trauma

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Numerous investigations have shown that the written emotional disclosure procedure pioneered by Pennebaker and Beall (1986) is associated with improvements in physical health (Smyth, 1998). In the wake of these findings, several explanatory hypotheses have been proposed to account for the observed improvements, including emotional inhibition (Pennebaker, 1989), social support (Pennebaker & Graybeal, 2001), cognitive adaptation (Park & Blumberg, 2002; Smyth, True, & Souto, 2001), and exposure to painful memories that have been heretofore avoided (Bootzin, 1997; Pennebaker, 1997; Sloan & Marx, 2004b). Foa and Kozak (1986) have argued that repeated exposure to a feared stimulus ultimately reduces pathological fear by activating faulty cognitive representations of the stimulus, possible responses, and their meanings (indicated by high initial levels of emotional arousal) and then providing corrective information about the stimuli, responses, and their meanings (indicated by reduced arousal to stimuli across sessions). It is in this way that the written disclosure procedure is thought to be similar to cognitive–behavioral interventions in which the individual is exposed to aversive stimuli either imaginally or in vivo. More specifically, it is speculated that repetitive confrontation of painful stimuli through written disclosure may lead to initial high emotional arousal followed by a subsequent reduction in arousal across the writing sessions, resulting in beneficial outcome.

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There is some evidence to indicate that the exposure hypothesis may only be relevant for individuals who experience pathological fear in the presence of aversive stimuli (Kloss & Lisman, 2002). In line with this notion, Sloan and Marx (2004a) randomly assigned college undergraduates with a trauma history and at least moderate levels of posttraumatic stress symptoms to either a disclosure or a control writing condition. Participants in the disclosure condition were asked to write about the most traumatic–distressing event of their lives (Pennebaker, 1997). Consistent with Pennebaker's (1997) writing protocol, participants were allowed to select the traumatic–distressing experiences about which to write. Furthermore, participants in the disclosure group had the choice to write about either the same or different experiences during each session. Those assigned to the control writing condition were asked to write about how they spent their time without describing any emotion or opinions. Emotional arousal in response to the writing sessions was examined with both physiological (salivary cortisol) and self-report measures. All participants then returned 4 weeks later to report on their psychological and physical health.

Findings indicated that, relative to the control group, the disclosure group showed significant improvements in self-reported psychological and physical health at follow-up. In support of the exposure hypothesis, the disclosure group showed significantly greater emotional arousal to the first writing session compared with the control group and the disclosure participants displayed significant reductions in emotional arousal across the writing sessions. Furthermore, greater emotional arousal (as measured by salivary cortisol) during the first writing session was significantly associated with improved psychological health for the disclosure participants.

Although these results have provided some support for the exposure hypothesis, some important questions remain unanswered. Most notably, exposure-based therapies emphasize the necessity of repeated exposure to the same stimulus (i.e., traumatic

memory) to reduce pathological fear (Rachman, 1980). Yet, the standard instructions for written emotional disclosure do not require that participants write about the same experience across writing sessions. The findings obtained by Sloan and Marx (2004a) raise the possibility that, contrary to the commonly held assumptions regarding exposure-based therapy, repeated exposure to specific stimuli may not be critical for the reduction of pathological fear. Rather, it may be the case that any stimulus that elicits prolonged and intense negative affect (e.g., fear, sadness) may result in the ultimate success of any exposure-based treatment. Indeed, this possibility has received some empirical support (e.g., Greenberg, Wortman, & Stone, 1996; Watson & Marks, 1971). Although a post hoc examination of the narratives in Sloan and Marx's (2004a) study indicated that only about one half of the disclosure participants wrote about the same event during each session, the lack of experimental manipulation used in this investigation made it impossible to examine the importance of writing repeatedly about the same event.

Thus, in the current study we further examined the exposure hypothesis for the written disclosure procedure by randomly assigning participants with a trauma history to write about either (a) the same traumatic event during each session, (b) a different traumatic event during each session, or (c) a trivial, nontrauma-related topic during each session. The use of these three experimental conditions allowed for a comparison of the importance of repeated exposure with a particular stimulus (i.e., traumatic memory) versus repeated elicitation of a particular response (i.e., negative affect and arousal). In addition to this primary goal, we also examined the longevity of outcome effects by including both 4-week and 8-week follow-up assessments.

In line with the exposure hypothesis, we expected that the repeat disclosure group would show greater improvement on all outcome measures at follow-up relative to the other groups. Furthermore, participants assigned to the repeat disclosure condition were expected to report significant reductions in emotional arousal relative to the other groups. We also expected significantly greater initial emotional arousal for both disclosure groups relative to the control group. Given that the different trauma disclosure participants would be writing about different trauma experiences each session, we anticipated continued emotional arousal after the first writing session for these participants. Finally, initial emotional arousal and a reduction in emotional arousal were anticipated to be associated with improvement at follow-up for the repeat disclosure participants.

Method

Participants

Participants were undergraduate students at a large, urban university. The recruitment procedure for this study was identical to the procedure used in our earlier study (see Sloan & Marx's, 2004a, study for a detailed description of recruitment procedure). Of the 96 participants contacted for this study, 81 (59 women, 22 men) were eligible and willing to participate. Two participants failed to return for follow-up assessment. The remaining 79 participants (59 women, 20 men) completed the entire study, including both follow-up periods. These 79 participants were included in subsequent data analyses.

The participants in the study were ethnically or racially diverse (45 were White and not of Hispanic origin, 23 were African American, 3 were Hispanic, 6 were Asian American, and 2 were of a mixed racial background) and had a mean age of 19.0 years (SD = 1.6 years). As is typical for many individuals who have experienced a traumatic event (McFarlane & de Girolamo, 1996), 76% (n = 60) of all participants reported experiencing more than one traumatic event. A fairly large percentage of the group reported that they had been in psychotherapy in the past (42%, n = 33) and/or had taken psychotropic medication in the past (37%, n = 29), with the majority of participants reporting poor to fair response.

Psychological and Physical Outcome Measures

Posttraumatic Stress Diagnostic Scale (PDS). The PDS (Foa, 1996) is a 49-item, self-report measure designed to aid in the detection and diagnosis of posttraumatic stress disorder (PTSD). Respondents report on PTSD symptoms that they have experienced within the last month, and the items on the PDS closely correspond to the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM–IV*; American Psychiatric Association, 1994) PTSD criteria. The PDS has strong psychometric properties (Foa, 1996).

Beck Depression Inventory—II (BDI–II). The BDI–II, a self-report measure of depressive symptoms, has strong psychometric properties (Beck, Steer, & Brown, 1996).

Pennebaker Inventory of Limbic Languidness (PILL). The PILL (Pennebaker, 1982) measures the frequency of common physical symptoms. The PILL is internally consistent and has good test–retest reliability (Pennebaker, 1982). As in other investigations of written disclosure (e.g., Greenberg et al., 1996), we included a single item that inquired about the number of days sick since the beginning of the semester.

Emotion Measures

Physiological reactivity. Salivary cortisol was used as an objective measure of emotional arousal. Samples were collected from each participant immediately before (prewriting) each writing session and, because of the lag time in observable changes in cortisol levels, 20 min after the session (postwriting). The saliva collection and assay procedures were identical to those used in our earlier investigation (see Sloan & Marx, 2004a, for a detailed description of the procedure).

All of the writing sessions occurred between the hours of 10:00 a.m. and 5:30 p.m. The average time of day for the prewriting saliva sample collection for the entire sample was 2:50 p.m. (SD = 200 min), with saliva samples collected in the afternoon for 77% of the participants. Distribution of participants collected in the morning and afternoon did not differ across the three conditions. Additionally, within participants, saliva collection times did not deviate by more than 1 hr for each session. Change in salivary cortisol level in response to each writing session was calculated by subtracting the cortisol μg/dL value at postwriting from cortisol μg/dL value at prewriting for each participant.

Self-reported emotion. The paper-and-pencil version of the Self-Assessment Manikin (SAM; Bradley & Lang, 1994) was used to obtain participants' subjective ratings of emotion in response to each writing session. The SAM uses manikin figures on a 9-point scale for each of the affective dimensions. On the valence dimension, the SAM figures range from a happy, smiling figure (1 = *very pleasant*) to an unhappy, frowning figure (9 = *very unpleasant*). On the arousal dimension, the SAM figures range from a calm figure with closed eyes and an inactive body (1 = *very calm*) to an excited figure with eyes wide open and an active body (9 = *very aroused*). Research has demonstrated that the SAM valence and arousal dimensions reliably covary with physiological reactions associated with emotional arousal (Lang, Greenwald, Bradley, & Hamm, 1993).

Procedure

During the first session, prior to writing and after obtaining informed consent, we used blocked randomization (using PDS symptom severity

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score) to assign participants to an experimental group. Additionally, because extent of traumatization is related to psychological outcome (Acierno, Kilpatrick, & Resnick, 1999) and, thus, might confound the results of the study, we balanced participant condition assignment for the number of traumatic events endorsed by participants on the PDS checklist. Finally, group assignment was also balanced for the gender of the participant. Participants then completed the PDS, BDI–II, PILL, and a demographic questionnaire.[1] The writing procedures used were the same as those used in Sloan and Marx's (2004a) study and involved three writing sessions, each 20 min in duration. However, some participants were assigned to write about the same traumatic experience at each writing session, whereas other participants were required to write about different traumatic events during each writing session. As in previous investigations, the control group wrote about trivial, everyday experiences with no emotion. With the exception of the demographic questionnaire, the same measures were completed at both follow-up assessments. Consistent with our previous study, the SAM was completed immediately following the completion of each writing session.

Results

Participant Characteristics

There were no significant group differences on the number of traumatic experiences endorsed, any demographic characteristics, or history of psychotherapy and/or psychotropic medication.

Outcome Assessment

An examination of the essays by the authors indicated that all participants in each condition followed the writing instructions. We examined between-group differences on each outcome variable using analysis of variance with condition as the between-groups factor and time as the repeated-measures factor.

Table 1 provides summary information about each outcome measure, for each condition, and each time period. As anticipated, a significant interaction between time and condition was found for posttraumatic stress symptom severity, $F(4, 75) = 8.07$, $p < .001$, $r_{\text{effect size}} = .87$ (Rosenthal, Rosnow, & Rubin, 2000). Scheffé post hoc tests revealed that the repeat disclosure group reported significantly diminished posttraumatic stress symptom severity at both the 4-week ($p < .01$) and 8-week ($p < .01$) follow-up assessments relative to the other two groups. A significant interaction effect was also found for depressive symptom severity, $F(4, 75) = 7.02$, $p < .001$, $r_{\text{effect size}} = .80$. Post hoc tests indicated that the repeat disclosure group reported significantly diminished depressive symptom severity at the 4-week ($p < .05$) and 8-week ($p < .001$) follow-up assessments compared with the other two groups. A significant interaction effect was also obtained for physical symptom complaints, $F(4, 75) = 5.49$, $p < .001$, $r_{\text{effect size}} = .76$, with post hoc tests indicating that the repeat disclosure group reported significantly fewer physical health complaints at both the 4-week ($p < .05$) and 8-week ($p < .05$) follow-up assessments relative to the other two groups. Lastly, a significant interaction effect was found for self-reported number of days sick, $F(4, 75) = 4.34$, $p < .01$, $r_{\text{effect size}} = .72$, with post hoc tests indicating that the repeat disclosure group reported fewer days sick at both the 4-week ($p < .05$) and 8-week ($p < .01$) follow-up assessments compared with the other two groups. In all analyses, the different disclosure group did not differ from the control group on any of the outcome variables.

Table 1
Mean Scores and (Standard Deviations) of Self-Report Measures at Baseline and Follow-Up Assessments as a Function of Condition

Assessment	Repeat disclosure condition ($n = 28$)	Different disclosure condition ($n = 26$)	Control condition ($n = 25$)
PDS			
Baseline	20.0 (6.1)	18.3 (7.6)	19.8 (9.5)
4-week	7.6 (6.1)	16.2 (9.2)	18.6 (9.9)
8-week	6.6 (5.6)	15.6 (9.7)	16.1 (7.5)
BDI–II			
Baseline	12.6 (9.8)	14.0 (9.2)	12.3 (5.3)
4-week	7.5 (6.8)	14.5 (10.7)	12.1 (5.3)
8-week	5.6 (4.0)	12.6 (9.4)	14.1 (6.3)
PILL			
Baseline	21.0 (9.4)	20.6 (9.9)	21.6 (11.2)
4-week	14.5 (8.9)	19.2 (10.1)	22.1 (11.5)
8-week	13.2 (8.0)	19.3 (10.1)	23.9 (12.2)
Days sick (since beginning of semester)			
Baseline	3.1 (4.0)	3.8 (2.2)	3.5 (4.9)
4-week	3.2 (3.1)	5.6 (4.5)	6.9 (6.7)
8-week	3.9 (3.8)	7.3 (4.8)	7.8 (4.4)

Note. PDS = Posttraumatic Stress Diagnostic Scale; BDI–II = Beck Depression Inventory—II; PILL = Pennebaker Inventory of Limbic Languidness.

Reliable change indices (RCIs; Jacobson & Truax, 1991) were computed with the mean and standard deviation of each outcome measure at baseline and 8-week follow-up, as well as the test–retest reliability of each measure. Findings indicate that the reductions in PTSD symptom severity (RCI = 4.52, $p < .01$) and physical symptom complaints (RCI = 2.06, $p < .05$) were clinically meaningful.

Emotional Arousal and Habituation

We examined between-group differences on salivary cortisol reactivity using analysis of variance, with condition as the between-groups factor and time as the repeated-measures factor. A significant interaction was found between time and condition, $F(2, 77) = 4.90$, $p < .01$, with Scheffé post hoc tests indicating that both disclosure groups showed significantly greater physiological reactivity to the first writing session compared with the control group ($p < .05$). Post hoc tests also indicated significantly greater physiological reactivity occurred for the different disclosure group compared with the control group in response to the second writing session ($p < .05$). No other significant differences were found. Next, group differences in the reduction (habituation) of physiological reactivity were examined with paired t tests, comparing cortisol reactivity to the first session with the last session. Findings indicate that the repeat and the different disclosure groups exhibited significant reductions in physiological reactivity (ps $< .01$ for repeat condition, ps $< .05$ for different condition), whereas no

[1] Writing instructions for each condition are available from Denise M. Sloan on request.

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significant reduction was found for the control group. Because significant reduction in physiological reactivity was observed for both disclosure conditions, we used independent sample *t* tests to examine group differences in reduction of physiological reactivity (using change in physiological reactivity from the first to the last session). Findings indicated that the repeat disclosure participants showed a trend for greater physiological reduction ($p = .06$).

Figure 1 displays self-reported ratings of valence (A) and arousal (B) in response to writing as a function of group. To examine group differences in initial self-reported emotional reactions (valence and arousal), we conducted one-way analyses of variance. Analyses indicated that the groups significantly differed in both valence, $F(2, 77) = 21.06$, $p < .001$, and arousal ratings, $F(2, 77) = 20.37$, $p < .001$. Scheffé post hoc tests indicated that both disclosure groups reported greater unpleasantness and arousal to the first writing session relative to the control group ($ps < .001$), although there were no significant differences in self-reported emotion between the disclosure conditions. Next, group differences in the reduction (habituation) of self-reported valence and arousal were examined with paired *t* tests (first session compared with last session). Results indicate that the repeat and the different disclosure groups reported significant reductions in both unpleasantness and arousal from the first to the last writing session ($ps < .001$ for repeat condition, $ps < .01$ for different condition), whereas no significant reductions were found for the control group. An examination of group differences in reduction of self-reported emotion indicates that the repeat disclosure participants showed a trend for greater reduction in self-reported emotion (valence, $p = .07$; arousal, $p = .10$).

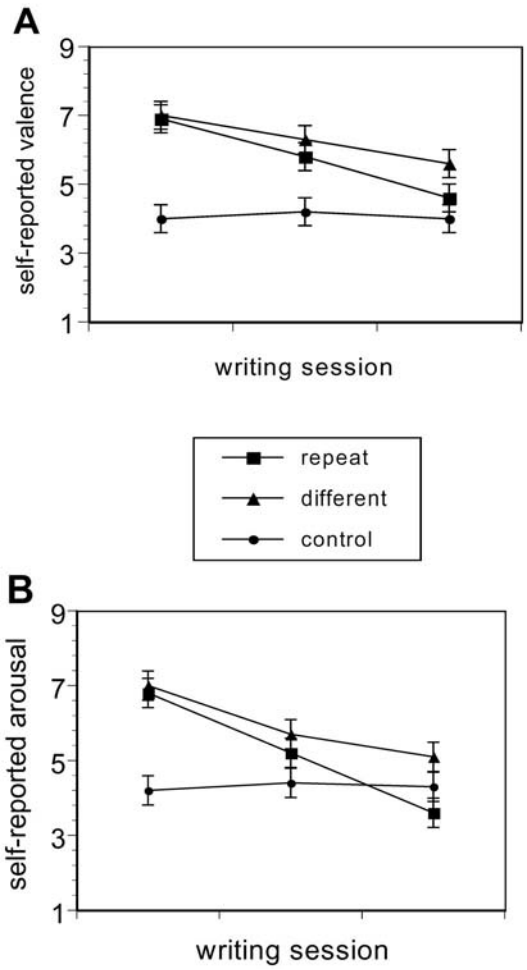

Figure 1. Mean self-reported valence (A) and arousal (B) in response to each writing session as a function condition. Bars represent standard error.

Lastly, we examined whether initial emotional arousal was related to outcome for the repeat disclosure participants. To address this question, we correlated salivary cortisol reactivity to the first writing session with outcome measure change scores (from baseline to the 8-week follow-up period), and we correlated the reduction in self-reported emotion from the first to the last session with outcome measure change scores. Greater salivary cortisol in response to the first session was significantly related to reductions in PTSD symptom severity ($r = -.42$, $p < .05$). Similarly, the reduction of self-reported unpleasantness and arousal from the first to the last writing session was significantly associated with reduction in PTSD symptom severity ($r = .42$, $p < .05$; $r = .39$, $p < .05$, respectively). Furthermore, the reduction of self-reported arousal was significantly related to the reduction in depressive symptoms ($r = .40$, $p < .05$). No other significant relationships were observed.

Discussion

In this study, only participants who were randomly assigned to write about the same traumatic experience at each session showed significant improvements in both psychological and physical functioning. These findings are intriguing, given that the standard writing protocol instructs participants that they can choose to write about the same or different traumatic or stressful experiences at each session. Previously, the written disclosure procedure had been shown to be effective in investigations in which investigators altered the writing instructions, such that participants assigned to the disclosure group were asked to write about the same topic each session (e.g., Klein & Boals, 2001; Lepore, 1997; Spera, Buhrfeind, & Pennebaker, 1994; Stanton et al., 2002). The current results are consistent with those findings.

It is also noteworthy that the test of clinical significance indicated a clinically meaningful reduction in PTSD symptom severity and physical symptom complaints for the repeat disclosure group. In our previous investigation (Sloan & Marx, 2004a), we observed a clinically meaningful reduction in depressive symptoms only. The reason for these inconsistent findings is unclear, and the differences in the writing instructions prohibit direct comparisons between the two studies. Nevertheless, these findings underscore the importance of examining clinical significance when investigating the written disclosure procedure.

The finding that the different disclosure group showed physiological activation in response to the second session, whereas the repeat disclosure group displayed physiological reactivity to the first session only suggests that habituation might have occurred at a faster rate for the repeat disclosure participants. This hypothesis is tentatively supported by the trend effect for reduction in ratings of unpleasantness and arousal.

The findings of our previous study have indicated that repeated exposure to specific trauma memories might not be critical for the

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habituation of a pathological fear response. However, the results of this investigation suggest that emotionally disclosing about the same event may be more beneficial than emotionally disclosing about different events across the writing sessions. This finding is consistent with the well-accepted notion that repeated exposure to specific stimulus is necessary for exposure therapy to be effective (e.g., Foa & Kozak, 1986). However, it should be noted that our finding represents an average across the participants in each group, and we altered the standard writing instructions in this study. It is feasible that some people may be best served by writing about the same event across all sessions, whereas others may do best if they write about different traumatic events at each session. Furthermore, some individuals may have the best outcome if they are allowed to choose what they write about at each session, as others have suggested (e.g., Pennebaker, 1997; Smyth, 1998). Individual differences were not examined in this study, and this would be an important issue to examine to understand how to best use the written disclosure procedure.

An important consideration when interpreting the findings reported here is that, although we systematically varied the instructions for each disclosure condition, we did not require participants in either of the disclosure conditions to write about any particular experience. In other words, we allowed participants in both disclosure conditions to independently choose the topic of their disclosures. Such a practice deviates considerably from typical exposure-based therapy procedures. In fact, approximately 40% of the participants assigned to both disclosure conditions did not write about any of the traumatic events that they reported on the PDS questionnaire. Instead they chose to write about other traumatic experiences, such as the death of a relative or divorce of their parents, that are not included in the *DSM–IV* definition of a traumatic stressor. In addition, because we allowed participants to choose what they disclosed, there is no way to know whether participants assigned to the disclosure groups actually chose to disclose the most traumatic experience or experiences of their lives. Thus, even though the results of this study suggest the possibility that exposure may be the mechanism of action for the written disclosure procedure, the procedural differences between the written emotional disclosure procedure and conventional exposure therapy precludes us from making any definitive statements.

Although we have focused on the exposure hypothesis of the written disclosure procedure, there are certainly other possible mechanisms of action (Sloan & Marx, 2004b). For instance, it has been suggested that cognitive restructuring (e.g., Smyth et al., 2001) may account for positive outcomes associated with written disclosure. Additionally, Pennebaker (1997) suggested that the benefits obtained from written disclosure may be maintained through the increase of social networks prompted by writing about upsetting life experiences. Thus, it is possible that more than one mechanism of action is associated with the written disclosure procedure, and it may be most informative to simultaneously examine such hypotheses.

Even though the findings of this study are encouraging, it should be noted that the sample consisted of college students who scored, on average, in the moderate range of PTSD symptom severity. Whether similar findings would be obtained with a clinical sample is questionable, and perhaps unlikely, given what is known about the average number of sessions necessary in PTSD treatment protocols (Foa & Rothbaum, 1998). Another potential shortcoming of this study is that the physical health outcome measures were based on self-report, which tends to be less reliable than objective measures of health. Additionally, although we included an objective measure of emotional reactivity to the writing session, the measure we selected (salivary cortisol) does not allow for an examination of within-session reactivity. As there has been some suggestion that within-session reductions of emotional responses are important to outcome (e.g., Foa & Kozak, 1986), it may be useful for future studies to include other physiological measures, such as heart rate, that would allow for an examination of within- as well as between-session reductions of emotional response. Finally, as 8 weeks is still a relatively short follow-up period, it will be important for future investigations to examine follow-up assessments beyond 8 weeks.

To the best of our knowledge, this study is the first to systematically alter instructions for written disclosure. The finding that only the repeat disclosure group showed beneficial effects from written disclosure provides support for the role of exposure possibly underlying the efficacy of written disclosure. Additional studies examining the effects of systematically altering the standard writing protocol would serve to further inform the field regarding the critical aspects of written emotional disclosure.

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