Research Article

RUMINATION IN POSTTRAUMATIC STRESS DISORDER

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Recent studies have shown that rumination is a powerful predictor of persistent posttraumatic stress disorder (PTSD). However, to date, the mechanisms by which rumination maintains PTSD symptoms are little understood. Two studies of assault survivors, a cross-sectional (N = 81) and a 6-month prospective longitudinal study (N = 73), examined several facets of ruminative thinking to establish which aspects of rumination provide the link to PTSD. The current investigation showed that rumination is not only used as a strategy to cope with intrusive memories but it also triggers such memories. Certain characteristics of rumination, such as compulsion to continue ruminating, occurrence of unproductive thoughts, and "why" and "what if" type questions, as well as negative emotions before and after rumination, were significantly associated with PTSD, concurrently and prospectively. These characteristics explained significantly more variance in PTSD severity than the mere presence of rumination, thereby indicating that not all ways of ruminative thinking are equally maladaptive. Depression and Anxiety 24:307–317, 2007. © 2006 Wiley-Liss, Inc.*

INTRODUCTION

Individuals with posttraumatic stress disorder (PTSD) frequently report being troubled by incessant ruminative thinking related to their trauma. Although DSM-IV [American Psychiatric Association, 1994] does not distinguish between intrusive ruminative thoughts and intrusive memories of the trauma in PTSD, recent theoretical considerations suggest that they are functionally distinct and should be examined separately [Ehlers and Clark, 2000; Ehlers and Steil, 1995; Ehlers et al., 2004; Joseph et al., 1997].

"Rumination" is commonly defined as repetitive and recurrent, self-focused negative thinking about past negative experiences and/or negative mood [e.g., Nolen-Hoeksema, 1991; Papageorgiou and Wells, 2003; Teasdale, 1999]. As its definition shows, rumination is closely related to the concept of worry. "Worry" is generally defined as recurring repetitive, uncontrollable thinking on potential negative life events [Borkovec et al., 1998; Roemer and Borkovec, 1993]. Thus, the major difference in definition is that the focus of the thoughts in worry is mainly future-oriented, whereas it is mainly past-oriented in rumination. As such, it is not surprising that worry has

typically been examined with respect to anxiety disorders, and rumination with respect to depression. Although the concepts of rumination and worry have emerged from distinct research traditions, recent research has indicated that they share more than just similarities in definition. An examination of shared and

common elements of the two constructs has found no specificity of worry and rumination to symptoms and thought content associated with anxiety and depression [Segerstrom et al., 2000]. Rather, it suggested that one common characteristic, repetitive thought, is related to both anxiety and depression. A study that submitted items from self-report measures of worry and rumination to factor analysis [Fresco et al., 2002] revealed that the items of the two scales loaded on different factors. Thus, individuals were able to differentiate between the two processes. However, scores on the factors were highly correlated with each other and demonstrated equally strong associations to both anxiety and depression. Given these results, it has been suggested that both rumination and worry serve a cognitive avoidance function and inhibit the ability to deploy adaptive coping resources [Fresco et al., 2002]. Although future research is needed to bear this hypothesis out, it would fit well with the seeming paradox that the diagnostic criteria of PTSD list both recurrent thoughts of the trauma and efforts to avoid thoughts of the trauma.

Considering the previously mentioned results, findings indicating that rumination plays an important role in the anxiety disorder PTSD seem also less surprising. Rumination emerged as one of the most powerful predictors of persistent PTSD in several studies [Clohessy and Ehlers, 1999; Ehlers et al., 1998; Murray et al., 2002; Steil and Ehlers, 2000]. Although these studies underline the importance of rumination in PTSD, they yield little about its nature. To date, the mechanisms by which rumination maintains PTSD symptoms are little understood. From a theoretical perspective rumination may be linked to PTSD by several means.

First, one might assume that rumination is a form of cognitive avoidance, and is thus comparable in its function to worry. For example, patients with generalized anxiety disorder are thought to use worry as a means to avoid confronting emotional issues [Borkovec et al., 1998]. Similarly, there might be a bidirectional relationship between intrusive memories and ruminative thoughts. Individuals with PTSD may use rumination as a means of escaping intrusive memories by focusing on the verbal channel and thinking about the trauma in a more abstract, less concrete way [Ehlers and Steil, 1995]. Previous studies have indicated that a ruminative response to intrusive memories is linked to PTSD [e.g., Michael et al., 2005b; Murray et al., 2002; Steil and Ehlers, 2000]. In turn, negative feelings experienced while ruminating may trigger more intrusive memories, which require more rumination, resulting in a cyclical process.

Second, if rumination does indeed serve a cognitive avoidance function, then there may be other significant consequences. It is assumed that successful emotional processing of negative experiences can only occur within an experiential mode in which the original emotions are activated and are thus open to change [Foa and Kozak, 1986; Teasdale, 1999]. Thus, whereas

dwelling on negative issues related to the trauma may initially blunt some aspects of the traumatic experience, it may not be adaptive in the long term, because it also inhibits emotional processing. Clinically, it has been observed that patients with PTSD focus on "why" and "what if" types of questions instead of the actual traumatic experience, suggesting that cognitive avoidance may be a facet of ruminative thinking. However, the presence of such processes and their role in the maintenance of PTSD has not been sufficiently empirically studied [Ehlers and Clark, 2000].

Third, the feelings associated with rumination may also play a direct role in PTSD. Although ruminative thoughts may offer a temporary distraction from the most emotional moments of the trauma, their content is still negative and they are likely to increase negative mood. In both depressed and nonclinical samples, ruminative thinking has been found to exacerbate depressed and dysphoric mood states, both concurrently and prospectively [Just and Alloy, 1997; Kuehner and Weber, 1999; Nolen-Hoeksema, 1991; Roberts et al., 1998].

What keeps rumination going even though it induces negative mood? Metacognitive factors may play a role. Wells and colleagues proposed that negative (e.g., "Worry is a sign of mental weakness") and positive (e.g., "Worrying on a negative topic reduces the likelihood of being overwhelmed if and when catastrophe strikes") metacognitive beliefs coexist in pathological worry and rumination [Papageorgiou and Wells, 2003; Wells and Matthews, 1994; Wells and Papageorgiou, 1995]. It is assumed that positive beliefs about worry and rumination serve to maintain the rumination, whereas negative beliefs provide a link to psychopathology. If the same metacognitive processes exist with respect to rumination in PTSD, negative metacognitions may contribute to broader PTSD symptomatology, whereas positive beliefs may serve to maintain ruminative thought.

Besides such metacognitions, the drive to ruminate in individuals with PTSD may also have other sources. For example, worry has been cast as the result of an unsuccessful attempt to prepare for possible future threats, or as a thwarted problem-solving process [Davey, 1994; Mathews, 1990]. In PTSD, rumination is focused on an aversive event that has already occurred, making it insoluble as a problem. PTSD is also characterized by a pervasive sense of current danger [Ehlers and Clark, 2000], suggesting that the belief in one's ability to prepare for or avert future threats is low. At the same time, the high impact of the trauma means that the drive to reach a solution or avert future catastrophe is likely to be strong. Consequently, if rumination is similar to worry in this respect, ruminative thoughts in PTSD might be highly repetitive and unproductive, and accompanied by a strong sense of compulsion.

The current research explored rumination in PTSD. Two studies with assault survivors, a cross-sectional

(Study 1) and a prospective longitudinal study (Study 2), were carried out. The participants completed a structured interview designed to address several aspects of rumination. The aims of these studies are as follows:

- To collect descriptive information about rumination in PTSD, such as how common it is and how much time people spend ruminating after a traumatic event.
- To systematically compare individuals with and without PTSD regarding the relationship between rumination and intrusive memories.
- To examine whether positive metacognitive assumptions about rumination are correlated with the amount of time people spend ruminating and whether negative metacognitive assumptions are associated with symptom severity.
- To investigate whether compulsion to continue ruminating, occurrence of unproductive thoughts, occurrence of "why" and "what if" type questions, and negative feelings during and after rumination are associated with PTSD severity and whether these variables explain more variance in PTSD severity than the mere presence of rumination.

A subsidiary aim of Study 2 was to test whether rumination measures predict subsequent PTSD severity over and above what can be predicted by initial diagnostic status.

METHODS

PARTICIPANTS

The recruitment procedure and detailed characteristics of the sample have been published elsewhere [Halligan et al., 2003].

In brief, participants were recruited via flyers sent out by several Victim Support (VS) Schemes in South England and Wales. VS is a charity that offers support to all victims of crime who reported the incident to the police. All participants experienced physical or sexual assault and opted into the study in response to the information sheet. Exclusion criteria for the study were as follows: history of psychosis, current substance abuse, and assault occurrence before the age of 16 or in the context of ongoing domestic violence. Ongoing domestic violence was an exclusion criterion, because ethical (e.g., we could not provide any help) and scientific (e.g., homogeneous sample) reasons required that the assault be a completed incident. Participants who met inclusion criteria and decided to take part in the study were either interviewed in their own home or in their local VS office. Participants interviewed at their VS office were reimbursed for their travel expenses. The study was approved by the U.K. Multicenter Research Ethics Committee, and participants gave written consent prior to participation.

Study 1—Cross-sectional investigation. The sample comprised 81 participants, 33 female and 48 male, with ages ranging from 20 to 65 years ($M = 37.27$ years, $SD = 11.86$). All participants had experienced an assault between 3 months and 5 years prior to the study. Prior to this assault, 21 (25.9%) had experienced another assault, 33 (40.7%) experienced an accident, 9 (11.1%) experienced a natural disaster, 5 (6.2%) experienced combat, 8 (9.9%) experienced imprisonment, 2 (2.5%) experienced torture, 16 (19.8%) experienced serious illness, and 27 (33.3%) experienced an unspecified other traumatic event. At time of study, 32 (40%) participants fulfilled PTSD criteria and 49 (60%) did not. A comparison of the PTSD and the no-PTSD groups (see Table 1) indicated that they did not

TABLE 1. Participant and assault characteristics

	Study 1			Study 2		
	PTSD	No PTSD	Statistic	PTSD	No PTSD	Statistic
Sex, N (%)			$\chi^2 (1,81) = .458$			$\chi^2 (1,73) = .150$
Female	15 (47%)	18 (37%)		13 (48%)	20 (43%)	
Male	17 (53%)	31 (63%)		14 (52%)	26 (57%)	
Age, M (SD)	36.5 (10.7)	37.8 (12.7)	$t (76) = -.492$	39.2 (13.4)	41.0 (15.6)	$t (71) = -.495$
Psychological characteristics M (SD)						
STAIT	56.86 (10.15)	41.00 (11.03)	$t (73) = 6.201^{**}$	55.80 (9.73)	39.53 (11.04)	$t (71) = 6.110^{**}$
BDI	22.11 (10.50)	7.02 (5.96)	$t (74) = 8.005^{**}$	18.13 (7.84)	5.86 (4.95)	$t (66) = 7.902^{**}$
PDS	29.00 (10.49)	8.081 (6.14)	$t (79) = 11.325^{**}$	30.19 (7.42)	10.22 (6.81)	$t (71) = 11.701^{**}$
Type of assault, N (%)			$\chi^2 (1,81) = .961$			$\chi^2 (2,73) = 1.275$
Physical assault	28 (88%)	47 (96%)		24 (96%)	46 (100%)	
Sexual assault	4 (13%)	2 (4%)		1 (4%)	0 (0%)	
Weeks since assault, M (SD)	64.38 (58.49)	49.22 (43.26)	$t (79) = 1.339$	8.67 (2.99)	7.13 (2.96)	$t (71) = 2.156^{*}$
Composite severity of assault, mean rank	45.08	38.34	$U (81) = 653.500$	42.09	34.01	$U (73) = 483.500$

$^{*} < .05.$
$^{**} < .01.$

differ with respect to sex, age, time (weeks) elapsed since the assault, and assault severity. As expected, the PTSD group had more severe PTSD and depressive symptoms, and a higher level of trait anxiety.

Study 2—Prospective longitudinal investigation. The sample comprised 73 participants, 33 female and 40 male, with ages ranging from 20 to 74 years ($M = 40.36$ years, $SD = 14.80$). The assault experienced by participants took place less than 3 months before the initial interview. There was no overlap between the participants of Study 1 and Study 2. Prior to this assault, 13 (17.8%) participants had experienced another assault, 25 (32.0%) had experienced an accident, 10 (13.7%) had experienced a natural disaster, 6 (8.2%) had experienced combat, 4 (5.5%) had experienced imprisonment, 1 (1.4%) had experienced torture, 15 (20.5%) had experienced serious illness, and 27 (37.0%) had experienced an unspecified other traumatic event. At initial assessment, 27 (37%) participants met diagnostic criteria for PTSD and 46 participants (63%) did not. Table 1 shows that there was no difference between the groups with respect to sex, age, and assault severity. The assaults of the no-PTSD group had occurred somewhat more recently than had those of the PTSD group. The small difference of about 10 days should not compromise the validity of the results, because one would expect rumination to decline over time. Thus, at most, there may be a slight bias in the direction of overestimating the severity of ruminative behavior in the no-PTSD group. As in Study 1, the PTSD group reported more severe PTSD and depressive symptoms, and a higher level of trait anxiety. Of the 73 participants, 71 also participated in the follow-up 6 months after the interview.

MEASURES

Posttraumatic stress disorder symptoms. We assessed PTSD symptoms with a modified version of the Posttraumatic Diagnostic Scale [PDS; Foa et al., 1997]. The PDS is a standardized self-report measure of PTSD symptoms in line with DSM-IV [American Psychiatric Association, 1994] diagnostic criteria. It shows good agreement with the Structured Clinical Interview for DSM-IV [Foa et al., 1997]. The first section of the PDS is a checklist concerning what traumatic events the participant has experienced, and the second section asks which traumatic event affected the person most. The PDS was modified in such a way that all following sections were answered with respect to the assault with which the interview was concerned. The third section asks about the objective and subjective threat associated with the assault. The fourth section examines PTSD symptoms. These are measured with a scale ranging from 0 (*never*) to 3 (*five times per week or more*) that asks for the presence and frequency of each of the 17 PTSD symptoms. Symptom scores can be added up to an overall sum

score measuring PTSD severity. The final section is concerned with whether the symptoms interfere with the lives of the participants. The presence–absence of PTSD was determined by assessing whether participants endorsed the required minimum number of symptoms specified in DSM-IV, whether the symptoms were at least present for a month,[1] and whether the symptoms caused at least two specific problems in functioning (e.g., work) or affected the overall level of functioning in all areas of life. In addition, a minimum score of 15 was required for a positive diagnosis, following the recommendations by Foa [1998].

Associated symptoms. Depressive and anxiety symptoms were measured with the Beck Depression Inventory [BDI; Beck et al., 1961, 1988] and the State–Trait Anxiety Inventory [STAI; Spielberger et al., 1983], respectively. Both are standardized scales with established reliability and validity.

General information questionnaire/semistructured interview. A questionnaire, which was filled in by the participants during the interview, assessed demographic characteristics. A semistructured interview, similar to the one used by Dunmore et al. [1999, 2001] assessed the nature and severity of the assault. Severity of the assaults was computed as a composite measure by combining participants' scores on each of the following measures of severity: number of assailants, duration of assault, use of verbal threat, extent of resultant injuries, and weapon use [Dunmore et al., 1999, 2001]. The interview further assessed current psychiatric status and psychiatric history by asking about psychological problems and treatment.

Rumination Interview. The Rumination Interview (see Appendix) is a structured interview of approximately 25 minutes' duration that asks a series of questions in a fixed order. Participants answered on given response scales. The interview covered the following areas:

1. Occurrence of rumination and time spent ruminating
2. Relationship between rumination and intrusive memories ("Rumination brings on unwanted recollections of the assault," "Ruminations brings unwanted recollections to an end")
3. Positive metacognitive assumptions about rumination (e.g., "Rumination is useful in order to come to terms with the fact that I was assaulted," 10 items, Cronbach's $\alpha = .893$)
4. Negative metacognitive assumptions about rumination (e.g., "Rumination is unhelpful as it prevents

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[1]For participants who completed the first assessment less than 1-month postassault, a positive diagnosis was assigned when all other criteria were met. This was only the case for two participants; both participants were interviewed 3 weeks after the assault and still had a positive diagnosis at the 6-month follow-up.

me from getting on with my life," 6 items, Cronbach's α = .758)

5. Compulsion to continue ruminating ("Once you have started, how driven do you feel to continue dwelling on the assault?")

6. Content of rumination: presence of "why" and "what if'" questions (e.g., "How things would have been if only I had done something differently," 6 items, Cronbach's α = .751)

7. Occurrence of unproductive thoughts during rumination (e.g., "The thoughts go the same way, repeat themselves," 9 items, Cronbach's α = .875)

8. Feelings while and after ruminating (e.g., "anxious"). The scale "negative feelings during rumination" comprised 7 items (Cronbach's α = .819), and the factor "negative feelings after rumination," 5 items (Cronbach's α = .769).

Questions from groups (3) to (8) were factor-analyzed to check whether they measured the same concept, merging the data sets of the two studies as the samples were sufficiently similar. For each question group, a common factor analysis without rotation was computed.[2] An item was considered to load onto a factor if its factor loading exceeded .40 (one item loaded on more than one factor and was excluded). Furthermore, items were excluded when the measure of sampling adequacy (MSA), which can be computed for each individual item, was below .60. It was also required that the overall Kaiser–Meyer–Olkin (KMO) test, which assesses the appropriateness of using factor analysis on the data, yield values greater than .70 [Backhaus et al., 2000]. These criteria led to the exclusion of four items (see Appendix).

PROCEDURE

Participants of Study 1 and Study 2 completed the BDI in the week prior to the interview, and the PDS, STAI, and general information questionnaire during the session. The semistructured interview about the assault and the Rumination Interview were conducted in the session. The session lasted approximately 2 hours. In addition to the measures described in this article, participants completed a number of other questionnaire and interview measures, gave a narrative of their assault, and conducted a word stem completion task, the results of which have been presented elsewhere [Halligan et al., 2003; Michael et al., 2005a,b]. The interviews were conducted by T. Michael or S. L. Halligan. In Study 2, participants completed the PDS again 6 months after the original assessment.

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[2]The factor analyses for question groups (3) and (4) were carried out with the software Mplus, which allows the use of an algorithm that takes into account that the data were measured as binary data even though one assumes that the items measure the individual's standing on a continuous underlying variable. Analyzing the data with SPSS (which was used for all other statistical tests) yielded the same results.

DATA ANALYSIS

Presence of rumination, as well as negative and positive beliefs about rumination in the PTSD and the no-PTSD groups were compared with χ^2 tests. The Mann–Whitney U test was used to compare the groups with respect to time spent ruminating. T-tests were employed to determine whether the relationship between intrusive memories and rumination differed between the groups. Pearson's correlations examined the associations between positive metacognitive assumptions and time spent ruminating as well as between negative metacognitive assumptions and PTSD severity. Biserial correlations assessed the associations between presence of rumination and PTSD severity. Pearson's correlations assessed the associations between characteristics of ruminative thinking and negative feelings linked to rumination with PTSD severity, as well as the item intercorrelations.

Hierarchical multiple regression analyses tested whether characteristics of and feelings associated with rumination predict PTSD severity (PDS) over and above what can be predicted on the basis of presence of rumination and whether rumination measures predict PTSD severity at 6 months over and above what can be predicted from PTSD diagnostic status at initial assessment. Although the current sample sizes were limited, the regression analyses are likely to yield reliable results, because the number of predictors is less than m (limiting sample size)/10 [Harrell, 2001].

RESULTS

PRESENCE OF RUMINATION AND TIME SPENT RUMINATING

In both studies, rumination was more common in the PTSD group than in the no-PTSD group. Furthermore, participants with PTSD spent more time ruminating than participants without PTSD in both studies (see Table 2).

RELATIONSHIP BETWEEN INTRUSIVE MEMORIES AND RUMINATION

Table 2 summarizes the results of the group comparisons with respect to intrusive memories. In Study 1, participants with PTSD reported more frequently than those without PTSD that rumination triggered intrusive memories about the trauma. In Study 2, this effect did not reach significance. In both studies, participants with PTSD indicated more frequently than those without PTSD that they used rumination to get rid of intrusive memories.

BELIEFS ABOUT RUMINATION

Positive metacognitive assumptions about rumination were not associated with the amount of time participants spent ruminating in either Study 1 ($r = -.041$, $P = .767$) or Study 2 ($r = -.038$, $P = .810$).

TABLE 2. Comparison of the PTSD and the no-PTSD groups on the variables presence of rumination, time spent ruminating, and rumination triggers/stops intrusive memories

	Study 1			Study 2		
	PTSD (N = 32)	No PTSD (N = 49)	Statistic	PTSD (N = 27)	No PTSD (N = 46)	Statistic
Presence of rumination, % (N)	93.8 (30)	51 (25)	χ^2 (N = 81) = 16.216, P<.001	88.9 (24)	45.7 (21)	χ^2 (N = 73) = 13.452, P<.001
Time spent ruminating, % (N)			U (N = 55) = 213.5, P = .003			U (N = 43) = 149.0, P = .037
<1 hour per week	40.0 (12)	72.0 (18)		37.5 (9)	63.2 (12)	
1 hour per week	16.7 (5)	24.0 (6)		4.2 (1)	15.8 (3)	
Several hours a week	10.0 (3)	4.0 (1)		41.7 (10)	15.8 (3)	
1 hour per day	13.3 (4)	0.0 (0)		12.5 (3)	5.3 (1)	
Several hours per day	20.0 (6)	0.0 (0)		4.2 (1)	0.0 (0)	
Rumination triggers intrusive memories, M (SD)	3.30 (1.1379)	2.00 (1.225)	t (50) = 3.958, P<.001	2.89 (1.243)	2.14 (1.389)	t (38) = 1.797, P = .080
Rumination stops intrusive memories, M (SD)	3.00 (1.200)	1.92 (0.997)	t (49) = 3.489, P<.001	3.56 (1.097)	2.10 (1.300)	t (37) = 3.754, P = .001

In Study 1, negative metacognitive assumptions about rumination were significantly correlated with PTSD symptom severity ($r = .349$, $P = .009$). In Study 2, there was a strong trend for this effect at interview time ($r = .289$, $P = .054$). However, negative metacognitive assumptions did not predict PTSD severity at 6 months ($r = .063$, $P = .684$).

ASSOCIATIONS AMONG PRESENCE AND CHARACTERISTICS OF RUMINATION, FEELINGS LINKED WITH RUMINATION, AND PTSD SEVERITY

The biserial correlation between the presence of rumination and PTSD symptom severity at interview time was $r = .482$, $P<.001$ in Study 1, and $r = .531$, $P<.001$ in Study 2. Presence of rumination at interview time also correlated with subsequent PTSD severity at 6 months ($r = .479$, $P<.001$) in Study 2.

Table 3 shows the correlations among the characteristics of ruminative thoughts, the feelings associated with rumination, and PTSD severity for those who reported rumination. Each of these measures was significantly linked with PTSD severity at interview time in both studies, and predicted subsequent PTSD severity in Study 2.

Thus, all these variables were used in the hierarchical regression analysis testing whether the characteristics of and the feelings associated with rumination (as assessed with the Rumination Interview) predicted PTSD severity (as assessed with the PDS), over and above what can be predicted from presence of rumination (as assessed with the Rumination Interview). Presence of rumination was entered in the first step, and compulsion to continue ruminating, occurrence of "why" and "what if" type questions, occur-

rence of unproductive thoughts, negative feelings during rumination, and negative feelings after rumination were entered in the second step.

The intercorrelations between the predictors are also reported in Table 3. Except for one intercorrelation (which just missed significance), all intercorrelations were significant. The results of the regression analyses are displayed in Tables 4 and 5. Presence of rumination explained between 23% and 28% of the variance in PTSD severity, concurrently and prospectively. When the other variables were entered in the second step, the explained variance rose to 40–62%. The change in R^2 was significant for Study 1 [F-change (5, 73) = 14.880, $P<.001$], as well as for Study 2 at interview [F-change (5, 65) = 4.304, $P = .002$] and at 6 months [F-change (5, 63) = 3.616, $P = .006$].[3]

ADDED VALUE OF RUMINATION MEASURES IN PREDICTING SUBSEQUENT PTSD SEVERITY OVER AND ABOVE INITIAL DIAGNOSTIC STATUS

Study 2 allowed us to examine whether rumination measures predict subsequent PTSD severity over and above what can be predicted by diagnostic status at initial assessment. When presence of rumination was entered in a hierarchical regression model as the second step (after initial diagnostic status), the prediction of PTSD severity at 6 months was significantly improved [F-change (1, 67) = 6.020, $P = .017$, R^2 change = .044]. Entering compulsion to continue

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[3]Because there was considerable variance in the time elapsed since the assault and this variable showed a significant difference between the groups in Study 2, we repeated the analyses controlling for this factor, which yielded the same pattern of results.

TABLE 3. Correlations between characteristics of ruminative thinking and PTSD severity and item intercorrelations

	1.	2.	3.	4.	5.	6.
1. Compulsion to continue ruminating		.370**	.575**	.428**	.505**	.593**
2. Occurrence of "why" and "what if" type questions	.288		.478**	.528**	.536**	.567**
3. Occurrence of unproductive thoughts	.617**	.589**		.585**	.668**	.679**
4. Negative feelings during rumination	.397**	.636**	.591**		.870**	.590**
5. Negative feelings after rumination	.269	.359*	.409**	.685**		.777**
6. PTSD symptom severity at interview	.620**	.462**	.628**	.556**	.505**	
7. PTSD symptom severity at 6 months	.609**	.370*	.551**	.428**	.450**	.751**

*Correlation is significant at the .05 level (two-tailed).
**Correlation is significant at the .01 level (two-tailed).
The triangle in the upper right-hand corner displays the correlations of Study 1 (bold), and the triangle in the lower left-hand corner displays the correlations of Study 2.

TABLE 4. Hierarchical regression predicting PTSD symptom severity in Study 1

Variables entered	B	$SE (B)$	β	t	P	Variance explained by model (R^2)
Model 1						.228
Presence of rumination	13.140	2.739	.477	4.798	<.001	
Model 2						.618
Presence of rumination	−24.107	4.918	−.876	−4.901	<.001	
Compulsion to continue ruminating	−.256	1.199	−.032	−.214	.831	
Occurrence of "why" and "what-if" type questions	4.092	1.588	.516	2.577	.012	
Occurrence of unproductive thoughts	6.393	1.821	.727	3.511	.001	
Negative feelings during rumination	1.807	2.442	.171	.740	.462	
Negative feelings after rumination	1.855	1.968	.170	.943	.349	

TABLE 5. Hierarchical regression predicting PTSD symptom severity in Study 2 at interview and at 6 months

Variables entered		B	$SE (B)$	β	t	P	Variance explained by model (R^2)
Model 1	At interview						.284
	At 6 months						.232
Presence of rumination	At interview	13.075	2.482	.533	5.269	<.001	
	At 6 months	10.730	2.371	.481	4.526	<.001	
Model 2	At interview						.462
	At 6 months						.403
Presence of rumination	At interview	−8.646	6.029	−.352	−1.434	.156	
	At 6 months	−7894	5.813	−.354	−1.358	.179	
Compulsion to continue ruminating	At interview	1.667	1.636	.233	1.019	.312	
	At 6 months	3.370	1.602	.523	2.104	.039	
Occurrence of "why" and "what-if" type questions	At interview	.746	2.657	.100	.281	.780	
	At 6 months	−.005	2.560	−.008	−.020	.984	
Occurrence of unproductive thoughts	At interview	2.251	2.365	.273	.952	.345	
	At 6 months	1.485	2.270	.199	.654	.515	
Negative feelings during rumination	At interview	1.993	2.758	.214	.723	.472	
	At 6 months	−.444	2.672	−.052	−.166	.869	
Negative feelings after rumination	At interview	2.383	2.866	.220	.831	.409	
	At 6 months	3.131	2.746	.317	1.140	.258	

ruminating, occurrence of "why" and "what if" type questions, occurrence of unproductive thoughts, negative feelings during rumination, and negative feelings after rumination as a third step resulted in a

trend for further improving the prediction [F-change $(5, 62) = 2.162$, $P = .07$, R^2 change = .073].

Taken together, the rumination measures explained an additional 12% of the variance in PTSD severity at

6 months, over and above what could be explained by previous diagnostic status alone (47%).

DISCUSSION

In line with clinical observations, rumination was common in participants with PTSD in our studies. Of the assault survivors with PTSD, 94% of the cross-sectional and 89% of the prospective longitudinal investigation reported ruminating about the assault and its consequences. Furthermore, the presence of rumination was significantly associated with PTSD severity, both concurrently and prospectively. At interview time, presence of rumination explained 23% of the variance in PTSD severity in the cross-sectional investigation and 28% in the prospective longitudinal investigation, in which it also accounted for 23% of the variance in PTSD severity at the 6-month follow-up. These findings underline theoretical assumptions and earlier results linking rumination and PTSD [e.g., Clohessy and Ehlers, 1999; Ehlers and Clark, 2000; Joseph et al., 1997; Murray et al., 2002].

However, rumination was not unique to assault survivors with PTSD. Of the assault survivors without PTSD, 51% in the cross-sectional and 46% in the prospective longitudinal investigation reported rumination, although they reported ruminating less frequently than survivors with PTSD. Thus, the occasional occurrence of ruminative thoughts about the trauma does not necessarily seem to be a sign of psychopathology. This observation suggests that a better understanding of which types of rumination are particularly maladaptive is required. It was therefore of particular interest that we found several factors to be linked significantly with PTSD severity: occurrence of "why" and "what if" type questions and unproductive thinking, compulsion to continue ruminating, negative feelings during and after rumination. These factors explained, in addition to presence of rumination, a significant proportion of the variance in PTSD severity at interview time (18–39%). They also considerably improved the prediction of PTSD severity at 6 months, explaining an additional 17% of the variance beyond presence of rumination.

Thus, we found preliminary support for the assumption that a strong engagement in "why" and "what if" type questions is maladaptive. Thoughts such as "How things would have been, if only I had done something differently" may be dysfunctional because they constitute a form of cognitive avoidance, thereby hindering the emotional processing of the trauma [Foa and Kozak, 1986; Teasdale, 1999]. This finding is also in line with a recent study by Watkins [2004], who found that writing about an induced failure in a conceptual–evaluative mode ("Why did you feel that way?") was maladaptive, whereas writing about it in an experiential mode ("How did you feel moment by moment?") was adaptive. Similarly, Treynor et al. [2003] showed that the reflection factor (e.g., "Analyze recent events to try to understand why you are depressed") of depressive rumination is associated with a reduction in depression over time, whereas the brooding factor ("Why do I always react this way?") is associated with increases in depression.

The finding that ruminative thoughts linked with PTSD are relatively unproductive and accompanied by a sense of compulsion fits with the suggestion that rumination is an impeded problem-solving process [Carver and Scheier, 1981; Davey, 1994; Mathews, 1990]. However, in our study we did not measure whether the content of ruminative thoughts in patients with PTSD is also characterized by a high number of thoughts that respresent attempts to problem-solve. Thus, it would be desirable for future studies to examine the extent to which the content of maladaptive rumination can be described as attempts to problem-solve, and how content and style of rumination relate to each other.

Negative affect during and after rumination was associated with PTSD severity. This result corresponds to the findings that link rumination to current and subsequent dysphoric mood in depression [e.g., Kuehner and Weber, 1999: Nolen-Hoeksema, 1991; Treynor et al., 2003]. Enhanced negative mood may increase the number of intrusive memories, because it may provide internal retrieval cues. In line with this assumption, we found in Study 1 that more participants with PTSD than participants without PTSD indicated that rumination triggers intrusions. This effect did not reach significance in Study 2 ($P = .08$), but this may be due to the lower statistical power of Study 2. At the same time, we observed that participants with PTSD used rumination significantly more often as a strategy to control intrusive memories than participants without PTSD. This finding is in line with the hypothesis that worrisome and ruminative thoughts function as a way of avoiding and blunting painful affective experiences [e.g., Borkovec et al., 1998; Fresco et al., 2002]. It further corroborates earlier results showing that a ruminative response to intrusions is linked to PTSD [Michael et al., 2005b; Murray et al., 2002; Steil and Ehlers, 2000].

According to the metacognitive model of rumination and psychopathology, positive metacognitive beliefs about rumination as a useful coping strategy should lead to rumination to deal with stress. Hence, we expected a positive correlation between such beliefs and time spent ruminating. However, we could not find such an association. The metacognitive model assumes further that the negative consequences of rumination should give rise to negative metacognitive beliefs about rumination that are, at least partially, mediating the relationship between rumination and the disorder [Papageorgiou and Wells, 2003]. Thus, we expected an association between PTSD severity and negative metacognitive assumptions. Our data partially confirmed this hypothesis. At interview time, a significant positive correlation was observed between negative

metacognitive beliefs and PTSD symptoms in the retrospective sample, and there was a strong trend for a similar association in the prospective sample ($P = .054$). However, negative metacognitive assumptions did not predict subsequent PTSD severity at the 6-month follow-up in the prospective study. This failure to find a predictive effect means that a significant role of such metacognitions in maintaining PTSD symptoms is not supported. The possibility that the concurrent associations we observed may be a function of the influence of PTSD symptom levels on negative appraisals regarding ruminative coping, rather than the converse, should be considered.

In summary, our results with respect to the role of metacognitive beliefs in ruminative coping are only partially in line with findings supporting the metacognitive model of rumination [e.g., Papageorgiou and Wells, 2003; Wells, 2005; Wells and Sembi, 2004]. Although prior work has not explicitly examined such cognitions in PTSD, this discrepancy may reflect limitations in our assessment of metaworry/rumination; our items were developed specifically for the current study of assault victims, and did not examine either frequency of metarumination or the extent to which the person believes the metarumination at its time of occurrence. Thus, our measurement of metacognitive beliefs may have lacked sensitivity. Future studies need to address the issue of metacognitive beliefs about rumination in PTSD before conclusions about its possible role can be drawn.

The nature of our investigation was explorative, and it had several limitations. First, for reasons of feasibility, no structured comprehensive diagnostic interview was conducted with the participants. The PTSD diagnosis relied on an interview score and other forms of psychopathology were also only assessed with questionnaires (e.g., depression) or screening questions (e.g., psychosis). Hence, it is not guaranteed that the PTSD or the no-PTSD group did not have other forms of psychopathology that might have influenced the results. Our investigation also lacked a precise definition of "rumination" and relied on the everyday understanding of the term. This was done so as not to bias answers by giving leading descriptions, but it might have also been a source of imprecision. In particular, our interview did not distinguish between longer spells of ruminative activity and relatively short thoughts. Short ruminative thoughts might correspond to what is termed "negative automatic thoughts" in depression and might be functionally different than longer spells of rumination. Furthermore, intrusive memories and ruminative thoughts about the trauma seem to occur in close temporal proximity, and people might need some training before they can distinguish between them. In consequence, some of the answers might have referred to intrusive memories rather than thoughts. The study was part of a larger investigation, and participants had already completed an interview about their assaults, and given an assault narrative and a word-priming task before doing the Rumination Interview. Yet it seems unlikely that these tasks confounded the results, because the tasks were clearly separate.

Despite these limitations, our results are intriguing because they demonstrate that rumination is an important factor in PTSD, which explains a substantial proportion of the variance in PTSD severity. Presence of rumination also significantly improved the prediction of PTSD symptom severity at 6 months over and above what could be predicted from PTSD diagnostic status. The prediction was further improved by several characteristics of ruminative thinking (discussed earlier). As such, if the current results can be replicated by future studies, rumination measures could help to identify those people who are at risk of developing chronic PTSD after a traumatic event. The early identification of people at risk of chronic PTSD is an important issue in the care of trauma survivors [e.g., Brewin et al., 2002; Ehlers and Clark, 2003; McNally et al., 2003]. It is therefore of theoretical and practical interest that certain characteristics of ruminative thinking are associated with persistent PTSD. Furthermore, PTSD treatments and early interventions might be improved by adding techniques that specifically target dysfunctional ruminative styles. To summarize, our investigation provides preliminary support for the importance of certain maladaptive ruminative thinking styles and shows that further investigations of rumination in PTSD seem warranted and important.

APPENDIX: ITEMS OF THE RUMINATION INTERVIEW

- Do you sometimes dwell on the assault and its consequences in your mind, going over and over things? Answer: Yes/No
- How much time do you spend dwelling on the assault: Answer: Less than 1 hour per week/1 hour per week/Several hours per week/1 hour per day/Several hours per day
- Does dwelling on the assault bring on unwanted recollections of parts of the assault that you would rather not think about?/Or does it happen that dwelling brings these recollections to an end and occupies your mind with other thoughts? Answers: Never/Rarely/Sometimes/Often/Always
- Positive metacognitive assumptions. Answers: Yes/No

Rumination is useful:

- in some respects
- to sort out things/put things in order in my mind
- to come to terms with the fact that I was assaulted
- to work out why it happened

– to prepare for future problems
– to work out how I could prevent something similar happening in the future
– to reassure myself that I did not do anything wrong
– to prepare me in case I encounter the assailant again
– to help me understand why I felt and behaved the way I did
– to help me remember/piece together what happened.

Excluded prior to analysis:
To find out what to do about my life

• Negative metacognitive assumptions. Answers: Yes/No

Rumination is unhelpful:

– in some respects
– it prevents me from getting on with my life
– it overwhelms me
– it takes too much time
– it makes me think I am a weak person
– it makes the event seem even worse.

• Once you have started, how driven do you feel to continue dwelling on the assault and its consequences? Answer: Not at all/A little/Moderately/Strongly/Very Strongly
• "Why" and "what if" type questions. Answers: Never/Rarely/Sometimes/Often/Always

– About why it happened to me
– What life would be like if the assault had not happened
– About what I would like to say or do to the assailant
– How unfair it is
– About what else might have happened
– About the long-term consequences of the assault.

Excluded prior to analysis:
How things would have been, if only I had done something differently
About other bad things that may happen in the future

• Unproductive thoughts. Answers: Never/Rarely/Sometimes/Often/Always

– I find it hard to put a stop to them
– My thoughts are racing
– The thoughts get more and more gloomy
– I seem to think in circles, coming back to the same things again and again
– The thoughts go the same way, repeat themselves
– I seem to drift from one topic to the next
– My thoughts are out of control
– I move from aspect of the assault and how things are now to another, without resolving any of them
– I know it makes me feel worse but I cannot stop myself from ruminating

• Negative feelings during rumination. Answer: Not at all/A little/Moderately/Strongly/Very strongly:

– Anxious
– Guilty
– Sad
– Numb
– Overwhelmed
– Ashamed
– Helpless

Excluded prior to analysis:
Angry

• Negative feelings after rumination. Answer: Not at all/A little/Moderately/Strongly/Very strongly:

– Exhausted
– Worried
– Sad
– Alienated
– Ashamed

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