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Rumination and self-defining memories in the context of health concerns

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Individuals with health anxiety report experiencing a strong sense of vulnerability to illness. Such beliefs may be driven by the biased recollection of past illness-related events. However, little research has explored the role of memory in health anxiety. In other disorders, rumination has also been identified as a process that leads individuals to recall memories dominated by the content of their concerns. This study examined the proposition that rumination might impact the content of "self-defining" autobiographical memories among 60 college students with varying health anxiety (35% with clinical-level health anxiety). Participants were randomised to experiential/ruminative self-focus conditions, and then they completed the Self-Defining Memory Task. Responses were coded for valence and illness-relatedness. Results indicated that rumination led participants to retrieve more illness-related self-defining memories, while higher health anxiety scores were associated with more negative, but not more illness-focused memories. Ruminative thinking appears to activate health concerns, and may play a role in maintaining ongoing health anxiety.

Keywords: Autobiographical memory; Health anxiety; Illness anxiety disorder; Rumination; Self

Health anxiety is defined by intense fear about the possibility of having or developing a serious physical illness (Creed & Barsky, 2004). Clinical health anxiety¹ is seen in approximately 5% of the general population, and up to 9% of patients at general medical practice clinics (Creed & Barsky, 2004; Gureje, Üstun, & Simon, 1997). For most individuals, these symptoms do not spontaneously remit (Creed & Barsky, 2004). Health anxiety is not only associated with considerable distress (Creed & Barsky,

2004), but is also responsible for a significant health system burden (Looper & Kirmayer, 2001).

There remain significant gaps in current understanding of the mechanisms involved in health anxiety. Cognitive-behavioural models suggest that what people think about their health is a potential maintaining factor in health anxiety. Catastrophic, dysfunctional health beliefs have been demonstrated among physically well individuals with clinical health anxiety (Fulton, Marcus,

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¹Throughout this article, the term "health anxiety" will be used to refer to distressing, functionally impairing concerns about health/illness, with "clinical health anxiety" used to describe severe, clinically relevant levels of health anxiety. "Illness anxiety disorder" will be used only regarding research involving individuals meeting this diagnosis. For conceptual consistency, "health anxiety" will be used to describe distressing illness-related concerns among medical populations, with the exception of studies describing distinct constructs (e.g., "fear of cancer recurrence").

& Merkey, 2011), as well as among physically unwell individuals, such as cancer patients with significant fear of cancer recurrence (Simard, Savard, & Ivers, 2010). These beliefs concern the prevalence of illness, the meaning of ambiguous symptoms, the results of an illness not being diagnosed immediately, and the meaning of “health” (Fulton et al., 2011). The focus on cognitions and beliefs in prevailing health anxiety models (Castellano et al., 2013; Rachman, 2012) implicates autobiographical memory, which may underpin health-related beliefs.

Health anxiety and memory processes

Autobiographical memory encapsulates a person’s memories for the events and issues in their life, and can be conceptualised as reconstructed recollections of personal experiences. The Self-Memory System theory highlights the reconstruction of autobiographical memories in accordance with a person’s current sense of self or “working self”. The model proposes that individuals have several working selves. The working self involves the currently active self-schemas (long-term representations of conceptual information about the self, including personal traits and possible selves), and an individual’s autobiographical memory base. It is thought to be responsible for the nature of the personal goals generated, and memories reconstructed (Conway, Singer, & Tagini, 2004).

Individuals experiencing health anxiety are likely to have active working selves involving ideas of the self as vulnerable to illness, as helpless in preventing illness, with current goals related to illness avoidance. Drawing from this model, negative psychological outcomes among individuals with illness concerns may emerge when people selectively draw upon memories consistent with their health-vulnerable working self and current illness-related concerns.

To date, little emphasis has been given to memory processes in health anxiety. Cognitive-behavioural models highlight that health anxious individuals might tend to be preoccupied with illness and health concerns, and accordingly would generate more health- and illness-related memories relative to individuals with less health anxiety (Castellano et al., 2013; Rachman, 2012). Indeed, prior research has found that individuals with health anxiety experience recurrent intrusive images related to negative beliefs about the self, and illness/death (Muse, McManus, Hackmann, Williams, & Williams, 2010; Wells & Hackmann,

1993) and that these images are strongly linked to memories, and to subsequent maladaptive behavioural responses, including avoidance, reassurance-seeking and rumination (Muse et al., 2010).

Relatedly, one study that examined autobiographical memory content (i.e., subject matter) in a sample of head and neck cancer patients found that cancer patients with acute stress disorder generated more cancer-related memories in response to both positive and negative cue words, and that six months post-diagnosis, generating more cancer-focused memories predicted greater helplessness and hopelessness about their cancer (Kangas, Henry, & Bryant, 2005). This suggests that cancer patients who are especially distressed by their illness may retrieve more cancer-related memories, consistent with ongoing fear and apprehension about their health and future. However, apart from this study, systematic biases in the content of memories have not yet been documented in the context of health concerns.

The Self-Memory theory would also predict that among individuals with health anxiety, health-related memories are more likely to be endorsed as linked to one’s sense of self, and recalled as “self-defining”. Self-defining memories (SDMs) are vivid, repetitive, affectively intense, representative of central themes relevant to the self (Singer & Salovey, 1993) and thought to be essential to the development of individuals’ internalised life narrative (Thorne, McLean, & Lawrence, 2004). Studies in other clinical populations have documented the sensitivity of SDMs to the content of individuals’ concerns. Sutherland and Bryant (2005) showed that individuals with PTSD generated more trauma-related SDMs than did a group of trauma survivors without PTSD. Similarly, Maccallum and Bryant (2008) demonstrated that bereaved individuals with complicated grief were more likely to endorse a memory of the deceased as “self-defining”, and more likely to be distressed by this, than bereaved individuals without complicated grief.

Although SDMs have not previously been examined in relation to health anxiety, previous correlational studies in illness populations have shown that those who endorsed a more illness-centric sense of self (e.g. “cancer patient” rather than “survivor”) showed poorer psychological outcomes (Deimling, Bowman, & Wagner, 2007; Park, Zlateva, & Blank, 2009; Riebel, Egloff, & Witthöft, 2013), even years into survivorship, after the health threat may have passed (Stam, Grootenhuis, Caron, & Last, 2006; Wenninger

et al., 2013). Consequently, it might be expected that individuals with health concerns would have a more health-related working self, and generate more illness-related SDMs.

THE ROLE OF RUMINATION

Ruminative thinking has been identified as one cognitive mechanism that may be involved in maintaining health anxious concerns (Fink et al., 2004; Marcus, Hughes, & Arnau, 2008; Simard et al., 2010). A ruminative response style, by definition, involves perseverative, circular and intrusive cognitions focused on the causes and consequences of one's symptoms (Nolen-Hoeksema, Morrow, & Fredrickson, 1993) and has been shown to lead to greater focus on the subject of one's concerns in other disorders such as depression (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998). Experimental manipulations have studied rumination by inducing distinct forms of "self-focus": *analytical self-focus* (akin to ruminative thinking), an abstract thinking style involving considering the causes, meaning and consequences of an experience, and *experiential self-focus*, a concrete thinking style involving considering the physical qualities related to an experience (akin to a "mindful" thinking style) (Watkins & Teasdale, 2004). Individuals with disorders such as depression show more maladaptive memory retrieval styles (generating memories in a more categorical than event-specific manner) when led to actively engage in analytical, ruminative self-focus, relative to when adopting an experiential self-focus (Watkins & Teasdale, 2004). The impact of analytical, ruminative self-focus on memory in individuals with health concerns is unknown. However, the extant literature suggests that individuals may engage in rumination as an avoidant response to intrusive health-related memories (Muse et al., 2010). In turn, rumination might increase the extent to which health-concerned individuals persevere on the content of their concerns (e.g. past examples of illness-vulnerability). Understanding the role of rumination on health-anxious remembering is an important next step towards refining treatments for health anxiety.

THIS STUDY

This study extended the literature on memory processes in health anxiety by examining the

effects of a rumination induction on the content focus of personally significant autobiographical memories. Given the dimensional nature of health anxiety (Ferguson, 2009), a college sample with varying health anxiety scores was used as a non-clinical model of health/illness concerns. This study also aimed to investigate whether rumination added to the potential role of other participant factors (e.g. personal illness history) to account for the content of SDMs. In order to examine processes of autobiographical memory relevant to individuals' concept of "self", Singer and Moffitt's (1992) SDMs methodology was used to enable participants to generate memories in line with their current views of themselves.

HYPOTHESES

- (1) *Rumination effects*: It was expected that participants led to think in an abstract self-focused manner would report more negative, and illness-related, SDMs, compared to participants who adopt an experiential self-focus.
- (2) *Health anxiety effects*: Higher health anxiety scores were expected to be associated with generating more negative, and more illness-related, SDMs.
- (3) *Rumination and health anxiety effects*: Rumination and higher health anxiety scores were together expected to predict more negative, and more illness-related, SDMs. In regression analyses, higher depression symptoms and having a personal/family illness history were also expected to contribute to more negative, illness-related memory content, in an additive capacity.

METHODS

Design

A two-group between-subjects design was employed (rumination condition: "experiential" versus "analytical" self-focus). Baseline health anxiety scores were examined as a continuous factor in regression analyses. A computer-generated algorithm was used to determine random allocation to the two conditions.

Participants

Sixty psychology undergraduate university students participated in return for course credit (41 females; mean age = 19.2, SD = 2.69). Participants with varying health anxiety were recruited via an online registration system.

Materials

Short Health Anxiety Inventory (SHAI; Salkovskis, Rimes, Warwick, & Clark, 2002). The 18-item SHAI assesses health anxiety independent of actual physical health (Fergus & Valentiner, 2011; Wheaton, Berman, Franklin, & Abramowitz, 2010). It includes 14 items derived from the original 64-item Health Anxiety Inventory that assess worry about health, awareness of bodily symptoms and feared outcomes in having an illness, in addition to the four-item Negative Consequences subscale (SHAI-NC), which does not assess health anxiety, but rather perceptions of the seriousness and impact of future illness (Alberts, Hadjistavropoulos, Jones, & Sharpe, 2013). It has shown good psychometric properties across clinical and non-clinical samples (Abramowitz, Deacon, & Valentiner, 2007; Abramowitz, Olatunji, & Deacon, 2007), and discriminates between individuals with clinical health anxiety and other anxiety disorders (Abramowitz, Deacon, & Valentiner, 2007; Salkovskis et al., 2002). Participants respond on a four-point scale, where higher scores indicate worse symptoms (range: 0–54). A total scale cut-off score of 18 is used to determine clinically significant health anxiety (Castellano et al., 2013; Rode, Salkovskis, Dowd, & Hanna, 2006). To examine both health anxiety, and catastrophic cognitions around future illness, this study included both the SHAI-total score (14-item main scale score, as used in Hadjistavropoulos et al., 2012) and the SHAI-NC supplementary subscale separately across analyses.

Depression, Anxiety, Stress Scales–Short Form (DASS-21; Lovibond & Lovibond, 1995). This 21-item scale consists of three seven-item subscales (depression, anxiety and stress), and has been extensively validated among non-clinical populations (Henry & Crawford, 2005). Participants rate the frequency of symptoms in the past week on a four-point scale (scores ranging from 0 to 42). The DASS-21 was incorporated to account for the well-documented effects of depression on the content of autobiographical memories retrieved (Williams et al., 2007).

Personal/family history of illness. Participants were asked, “Have you, or anyone in your immediate family, been diagnosed with any of the following?” Response options included cancer, cardiovascular disease, diabetes, chronic pain, glandular fever and “other serious or chronic illness” (specified by participants).

Procedures

Baseline questionnaire measures. Following written informed consent, participants completed the SHAI and DASS-21, followed by their randomly assigned rumination (self-focus) induction.

Rumination induction. Watkins and Teasdale’s (2004) experiential and analytical self-focused attentional manipulations were used. Participants in both groups were first given condition-specific instructions to read, with participants randomised to the concrete, experiential condition told to “Focus your attention on your experience of” and participants in the abstract, analytical self-focus condition instructed to “Think about” each stem. All participants then spent 10 minutes contemplating the same 28 self-focused sentence stems (e.g. “your physical sensations”), randomly presented for 20 seconds each in white text on a black laptop screen. To check the effectiveness of this induction, participants rated the abstract-concreteness of their thinking on a 10-point visual analogue scale (1 = not at all abstract, completely concrete, 10 = not at all concrete, completely abstract) (Watkins & Moulds, 2005).

SDM task. In order to assess personally significant memories, participants completed Blagov and Singer’s (2004) SDM task. Participants were told by the experimenter that a SDM was one which was important to them, and strongly related to who they are as a person. Participants were asked to recall three SDMs and verbally describe them to the experimenter as specifically as possible (as a discrete event occurring on a particular day). Finally, to check for systematic differences in memory appraisals and qualities, participants were also asked to rate on separate 10-point Likert scales how anxious they felt as they recalled the memory (1 = not at all, 10 = extremely anxious) and how frequently they typically think about this memory (1 = never think about it, 10 = think about it several times a day). All responses were audio-taped and transcribed for coding. Memories were coded dichotomously for valence (positive/

negative), and illness-content (illness-related/not). “Illness-related” memories revolved around the participant, or someone close to them, becoming ill, having a health scare, being preoccupied or concerned with physical symptoms, or dying (e.g. “*One time I was getting ice-cream with my cousin and she started having a seizure ...*”, “*Going for my knee surgery, and feeling very inexperienced and scared ...*”). A second independent rater coded 20% of memory responses. The mean kappa reliability coefficient was .89 for valence, and .77 for illness-related ratings.

Post-induction measures. Following the SDM task, participants reported their personal/family illness history. This was done at the experiment’s conclusion so as not to alert participants to the study’s focus on health. Finally, participants were debriefed.

Analytic strategy

Analyses were conducted using the Statistical Package for the Social Sciences (SPSS) Version 21.0. T-tests were calculated to analyse the manipulation check. Separate analyses of variance (ANOVA) were undertaken to determine main effects for SDM valence (positive/negative) and illness-related content (present/absent). Subsequent multivariable linear regression analyses were also undertaken to examine the participant factors that might predict SDM content. Two regression analyses were conducted, predicting first the number of negative SDMs, and then the number of illness-related SDMs, recalled by participants. In each, participants’ personal/family illness history (Step 1), DASS-21 depression symptoms (Step 2), health anxiety scores (SHAI-total scores), catastrophic perceptions of future illness (SHAI-NC score) (Step 3) and rumination condition (Step 4) were entered. This order of entry allowed the regression analyses to account firstly for the potential links between illness-related memories and actual illness exposure, followed by relevant psychological variables, and finally the impact of the experimental induction. Prior to undertaking these regressions, multicollinearity tests were conducted using an iterative process of examining variance inflation factor (VIF) values for all independent variables, to rule out any problematic collinearity between the predictors. The threshold of 3 or lower for acceptable VIF values was used (Hair, Black, Babin, & Anderson, 2009; Montgomery & Peck, 1982).

RESULTS

Participant characteristics

SHAI-total scores ranged from 3 to 33, with 21 (35%) participants meeting the clinical cut-off for health anxiety (Castellano et al., 2013). The two rumination conditions did not differ across any demographic factors (Table 1).

Manipulation check

On the post-self-focus induction manipulation check, participants in the rumination condition reported significantly more abstract, and less concrete, thinking ($M = 60.69$, $SD = 19.44$), compared with the experiential group ($M = 48.21$, $SD = 19.06$; $F_{(1, 56)} = 5.978$, $p = .018$; Cohen’s $d = .65$), indicating that the rumination induction was effective.

SDM responses

Out of their three SDMs, participants generated a mean of 0.10 illness-related SDMs ($SD = 0.30$, range = 0–1; reported by $n = 9$ participants or 15.3%) but a mean of 0.97 negative memories ($SD = 0.81$, range = 0–3; $n = 42$, 69.5%). Participants who met the cut-off for clinical health anxiety did not show more illness-related SDMs relative to participants with sub-clinical SHAI scores, however ($F_{(1, 59)} = 1.890$, $p = .175$; $M_{\text{clinical}} = 0.038$, $SE_{\text{clinical}} = 0.064$; $M_{\text{non-clinical}} = 0.147$, $SD_{\text{non-clinical}} = 0.046$). In partial support of Hypothesis 1, ANOVAs indicated that the rumination induction led participants to generate significantly more *illness-related* SDMs ($F_{(1, 59)} = 7.004$, $p = 0.010$; $M_{\text{rumination}} = 0.20$, $-SD_{\text{rumination}} = 0.41$; $M_{\text{experiential}} = 0.00$, $SD_{\text{experiential}} = 0.00$; Cohen’s $d = .69$) relative to the experiential self-focus group. Rumination condition did not significantly impact the number of negative SDMs reported ($F_{(1, 59)} = 0.943$, $p = .336$; $M_{\text{rumination}} = 1.07$, $SD_{\text{rumination}} = 0.87$; $M_{\text{experiential}} = 0.86$, $SD_{\text{experiential}} = 0.74$; Cohen’s $d = .26$). Regarding memory appraisals, rumination groups did not significantly differ on how anxious they felt as they recalled their SDMs ($F_{(1, 59)} = 2.001$, $p = 0.163$; $M_{\text{rumination}} = 3.36$, $SD_{\text{rumination}} = 1.75$; $M_{\text{experiential}} = 2.60$, $SD_{\text{experiential}} = 1.82$; Cohen’s $d = .43$) or how frequently they thought of these memories ($F_{(1, 59)} = 0.035$, $p = 0.853$; $M_{\text{rumination}} = 5.57$, $SD_{\text{rumination}} = 1.66$; $M_{\text{experiential}} = 5.50$, $SD_{\text{experiential}} = 1.89$; Cohen’s $d = .04$).

TABLE 1
Participant characteristics presented according to experimental group

	Total sample (N = 60)	Rumination condition		Test-value	Sig. p-value ^a
		Experiential (n = 30)	Analytical (n = 30)		
Number of females	41 (68%)	20 (66.6%)	21 (70%)	$\chi^2 = .77$	.781
Mean age (range: 17–30)	19.22 (2.69)	18.70 (2.25)	19.73 (3.02)	$t = -1.505$	.138
SHAI total scale score	16.37 (6.46)	15.63 (5.67)	17.10 (7.19)	$t = -.877$	.384
SHAI-NC score	3.03 (2.07)	2.73 (1.78)	3.33 (2.31)	$t = -1.127$	.264
SHAI avoidance behaviours	12.87 (11.21)	14.27 (12.50)	11.47 (9.76)	$= .967$	.338
SHAI reassurance-seeking	18.92 (10.18)	19.43 (9.94)	18.40 (10.56)	$= .390$	.698
DASS-21 – depression subscale	9.17 (6.68)	8.67 (6.35)	9.67 (7.07)	$t = -.576$	.567
DASS-21 – anxiety subscale	8.70 (7.31)	8.53 (6.97)	8.87 (7.75)	$t = -.175$	.862
DASS-21 – stress subscale	14.70 (8.38)	14.60 (9.22)	14.80 (7.60)	$t = -.092$	.927
DASS-21 total score	32.57 (18.91)	31.80 (20.21)	33.33 (17.82)	$t = -.312$	.756
Personal/family illness history	38 (63%)	16 (53%)	22 (73%)	$\chi^2 = 2.584$	.108

Standard deviations appear in parentheses.

^aCategorical variables (gender and illness history) analysed using chi-square analyses; other variables analysed using *t*-tests.

SHAI = Short Health Anxiety Inventory; SHAI-NC = Short Health Anxiety Inventory-Negative Consequences subscale; DASS-21 = Depression, Anxiety, Stress Scales – Short Form. Personal/family illness history refers to the proportion of participants who indicated that they, or someone in their immediate family, had experienced a serious or chronic illness.

Predictors of SDM content

Multicollinearity analyses conducted prior to the regression analyses indicated little evidence for problematic multicollinearity among predictors, with VIF values ranging from 1.04 to 2.20 across all variables.

In the first regression analysis predicting the negativity of SDMs, only health anxiety symptoms (SHAI-total scores) emerged as a significant predictor, with higher health anxiety associated with more negative SDMs ($F_{(1, 57)} = 8.933$, $p = 0.004$), accounting for approximately 13% of the variance in memory valence. This was partially consistent

with Hypothesis 2. Neither the personal/family illness history and depression nor the rumination manipulation added to this (Table 2).

Only ruminative thinking significantly predicted having a greater degree of illness-related SDM content, relative to the experiential self-focus condition, partially supporting Hypothesis 1 ($F_{(1, 57)} = 7.004$, $p = 0.010$). This explained approximately 11% of the variance in content. Again, having a personal/family illness history, health anxiety and depression symptoms did not add to this (Table 2). No evidence supported the hypothesised additive effects of rumination and health anxiety.

TABLE 2
Final multivariate regression models predicting negativity and illness-relatedness, of SDMs

Outcome	Variables	β	SE β	β	ΔR^2	ΔF	t	p
No. of negative SDMs	SHAI-Total	.216	.270	.368	.135	8.933	2.989	.004
	Health history	-.080	–	–	–	–	-0.634	.529
	DASS-21-D	.020	–	–	–	–	0.158	.875
	SHAI-NC	.042	–	–	–	–	0.305	.761
	Rumination	.103	–	–	–	–	0.828	.411
No. of illness-related SDMs	Rumination	.200	.076	.331	.109	7.004	2.647	.010
	Health history	-.073	–	–	–	–	-0.569	.572
	DASS-21-D	-.207	–	–	–	–	-1.670	.100
	SHAI-Total	-.028	–	–	–	–	-0.220	.827
	SHAI-NC	-.139	–	–	–	–	-1.103	.275

SDM = Self-Defining Memory; SHAI-Total = Short Health Anxiety Inventory – total score. Rumination = experimental rumination condition where 0 = experiential self-focus and 1 = analytical self-focus.

DISCUSSION

This study examined the impact of ruminative thinking on self-defining autobiographical memories among a non-clinical sample with varying health anxiety scores. The SDM paradigm was used to evaluate the impact of rumination on the content of personally important memories. Our hypotheses were partially supported. Ruminative thinking emerged as a significant predictor of more illness-related SDMs, while higher health anxiety scores were associated with more negative SDMs. This study also demonstrated that health anxiety scores predicted more negative SDMs, above and beyond rumination or depression. As health anxiety is by definition concerned with future illness (a typically negative event), health anxiety may also be associated with tendencies towards retrieving other negative events, both in the past and in the future. This finding accords with Wells and Hackmann (1993) who found that clinically health-anxious individuals showed strong negative beliefs both about the self and about illness/death. Further, findings indicated the potential for rumination to potentiate the accessibility of illness-related memories, even in a non-clinical sample with limited, varying health anxiety. These somewhat counterintuitive findings may have been impacted by other, unmeasured, factors, such as generalised anxiety or neuroticism. These findings were also not explained by participants' own personal/family illness history, suggesting that there may be something quite distinct about the way in which ruminative thinking facilitates a focus on one's area of perceived vulnerability.

Previous research has highlighted that individuals with health anxiety use rumination as an avoidant response to intrusive, distressing illness-related memories and images (Muse et al., 2010). The present findings add to this by suggesting how rumination may function to heighten illness concerns, in turn increasing the retrieval of thematically consistent autobiographical memories. This finding accords with research highlighting the role of rumination as a potential maintaining factor in the context of clinical health anxiety (Marcus, Gurley, Marchi, & Bauer, 2007; Marcus et al., 2008; Muse et al., 2010) and underlines the potential role of rumination in maintaining individuals' focus on an area of concern (e.g. vulnerability to illness) in a manner that fits with their working sense of

self. The rumination induction chosen for the present studies may have been particularly potent for individuals with health concerns; many of the manipulation instructions prompted individuals to consider things such as "*the physical sensations in your body*". However, as the prompts were identical across both self-focus conditions, the rumination effects that emerged indicate that there is nevertheless something distinct about this abstract cognitive style.

The current findings also highlight how rumination might function to perpetuate maladaptive, illness-related concerns within the context of the self-memory system. Research to date indicates that activating different 'working selves' is strongly associated with the accessibility of different memories consistent with this, such that activating positive memories may increase the accessibility of a positive working self, for example (Çili & Stopa, 2015; Conway et al., 2004). By facilitating the retrieval of negative self-constructs (Lyubomirsky et al., 1998), it is plausible to expect that abstract, ruminative thinking may increase the accessibility of illness-related memories and perpetuate the activation of the 'health-vulnerable' self. As working selves were not indexed in this study, future research should examine the link between activated working selves and memory retrieval in health anxiety.

Some limitations to this study must be recognised. This study used a small, analogue sample, and although 35% of the sample had clinical-level health anxiety scores, the present results may not be generalisable either to clinical health anxiety or to medical populations. Relatedly, the overall number of memories coded as illness-related was relatively small; this could relate to the non-clinical sample used (with fewer personal illness experiences), the small sample size, or to the open-ended tasks used. Future studies might better activate illness-related memories through explicitly asking participants to consider past illness experiences, or through the mortality salience paradigm (e.g., Routledge et al., 2010). Additionally, the participants were predominantly female, young, without comorbid anxiety and depression symptoms. By contrast, individuals with significant health anxiety may be more likely to experience elevated depression symptoms concurrently, potentially impacting autobiographical memory processes. Finally, although the present rumination induction has been successfully used to impact the quality of memories retrieved (Watkins & Teasdale, 2004), it is

unclear how well such an experimental induction might approximate the kind of chronic, daily rumination seen in clinical populations. These limitations notwithstanding, the current data indicate that in the context of health concerns, rumination may be one mechanism that increases the accessibility of distressing, illness-related memories, potentially playing a role in maintaining serious health concerns.

The present findings have implications for health anxiety in other, illness-related contexts, such as in cancer survivorship. Although there is a greater degree of reality to health concerns in these contexts, nevertheless studies suggest that cancer patients with an overly illness-focused sense of self experience poorer psychological adaptation (Deimling, Bowman & Wagner, 2007; Park et al., 2009). Ruminative thinking has previously been suggested as one factor that may perpetuate illness-related anxiety in the form of “fear of cancer recurrence” (Lee-Jones, Humphris, Dixon, & Hatcher, 1997). More recently, researchers have linked the cancer-related attentional biases and rumination with negative psychological outcomes (Chan, Ho, Tedeschi, & Leung, 2011). The present findings implicate rumination as a viable process to target in interventions. Together, these studies highlight the potential role of rumination in perpetuating health-concerned appraisals and autobiographical memories.

The apparent role of rumination in perpetuating health-focused memories underscores the relevance of mindfulness in the treatment of health anxiety, such as in Mindfulness-Based Cognitive Therapy (MBCT) (McManus, Surawy, Muse, Vazquez-Montes, & Williams, 2012). Proponents of MBCT have highlighted its potential to mitigate the ruminative processes that may perpetuate health anxiety (McManus et al., 2012; Segal, Williams, & Teasdale, 2002). The present findings suggest that targeting rumination through mindfulness may be a means to reducing health anxiety. Recent evidence supports the effectiveness of mindfulness within CBT frameworks, even when delivered online (Hedman et al., 2013). Whether mindfulness can be effectively applied to verbal-based rumination processes in illness populations is a question deserving of future study. Several trials are currently underway that incorporate mindfulness-based skills to treat fear of cancer recurrence in cancer patients, and may shed light on this (Butow et al., 2013).

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