



# Stress-related thinking predicts the cortisol awakening response and somatic symptoms in healthy adults

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Received 29 March 2012; received in revised form 5 July 2012; accepted 5 July 2012

## KEYWORDS

Stress;  
Expressive writing;  
Cortisol;  
Perseverative cognition hypothesis;  
Common cold;  
Rumination

## Summary

**Objective:** Perseverative cognition (i.e., worry, stress-related thinking) may prolong stress-related physiological activation. However, its role within the context of the written emotional disclosure paradigm has not been examined. This study explored: (1) the effects of stress-related thinking on the cortisol awakening response and upper respiratory infection symptoms and; (2) the efficacy of two expressive writing interventions on these health outcomes.

**Methods:** Participants were randomly assigned to write about their most stressful life experience (using the Guided Disclosure Protocol;  $n = 39$ ) or positive life experiences ( $n = 42$ ) or plans for the day ( $n = 41$ ) for 20 min on 3 consecutive days. Participants reported the extent to which they thought about their assigned writing topic during the study and in the past (event-related thought). Cortisol was measured at 0, 15, 30 and 45 min after awakening on 2 consecutive days at baseline and 4 weeks post-intervention. Upper respiratory infection (URI) symptoms were assessed at baseline, at 4 weeks and at 6 months.

**Results:** Results showed that the writing interventions had no beneficial effects on any of the outcome measures. However, a significant interaction was found between event-related thought and condition on the cortisol awakening response at 1 month follow-up and URI symptoms at 6 months. Among participants who wrote about stressful/traumatic events, higher stress-related thinking during the study predicted increased cortisol levels and URI symptoms compared to participants who reported low stress-related thinking.

**Discussion:** These findings are broadly consistent with Brosschot et al.'s (2006) perseverative cognition hypothesis and highlight the importance of ruminative thinking in understanding stress–health processes.

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## 1. Introduction

Recent developments in stress theory have highlighted the importance of worry, rumination and repetitive thought in improving our understanding of stress–disease relationships. [Brosschot et al. \(2006\)](#), in their perseverative cognition hypothesis (PCH), have suggested that worry or repetitive thinking may lead to disease by prolonging stress-related physiological activation by amplifying short-term responses, delaying recovery or reactivating responses after a stressor has been experienced. There is a growing body of evidence that has demonstrated that perseverative cognition is associated with somatic outcomes cross-sectionally and prospectively (see [Verkuil et al., 2010](#) for a review). For example, [Brosschot and van der Doef \(2006\)](#), in a worry intervention study, showed that reduction in worry was associated with a decrease in somatic complaints. Recently, a more sophisticated design using electronic diaries, [Verkuil et al. \(2012\)](#) clearly demonstrated that worry intensity was predictive of the frequency of somatic complaints, and intensity mediated the effect of stressful events on these complaints.

In terms of the stress hormone cortisol, [Zoccola et al. \(2008\)](#) have found that rumination following a laboratory stressor is associated with increased and prolonged elevations in cortisol levels. More recent support for the PCH comes from [Zoccola et al. \(2011\)](#), who showed that participants who spent time worrying or ruminating about past events exhibited greater increases in cortisol levels the following morning (known as the cortisol awakening response; CAR). The CAR has been subject to much empirical and scientific debate in terms of its function, significance and in identifying factors that influence it (see [Clow et al., 2004](#); [Fries et al., 2009](#)). These latest findings are important as they indicate that the CAR is sensitive to stress-related thoughts (or perseverative cognition) in the short-term and that these cognitions account in part for the individual variability in the CAR. An important next step is to establish whether perseverative cognition explains variability in the CAR in the longer term as well as in other well established stress-related health outcomes. Upper respiratory infections, and in particular, the common cold syndrome, are responsible for 50% of all acute illnesses ([Marland et al., 2007](#)). Moreover, a large body of work has demonstrated that psychological stress is associated with increased susceptibility to upper respiratory infections, and that the type and duration of stressors are important ([Cohen, 2005](#)). However, little or no research has explored the extent to which perseverative cognition is associated with variations in susceptibility to the common cold.

### 1.1. Stress disclosure and perseverative cognition

The beneficial effects of the disclosure of stressful or traumatic experiences, by expressive writing, on health outcomes have received considerable support over the last twenty-five years (e.g., [Pennebaker and Beall, 1986](#); [Petrie et al., 1995, 2004](#); [Frattaroli, 2006](#)). The original paradigm developed by [Pennebaker and Beall \(1986\)](#) and later modified versions, such as the Guided Disclosure Protocol ([Gidron et al., 2002](#)), have been found to produce clinically significant changes on a range of physiological and physical health

outcomes. For example, improvement in lung function in asthmatic patients, enhanced responses to hepatitis B vaccination in healthy adults, increased CD4+ lymphocyte counts in HIV patients and lower symptom levels and clinic visits in frequent attenders have all been observed following written stress disclosure in the short and longer term (e.g., [Petrie et al., 1995, 2004](#); [Smyth et al., 1999](#); [Gidron et al., 2002](#)). Nevertheless, a relatively large number of studies have failed to find positive results. It has been suggested that the efficacy of the intervention is moderated by a number of variables and that the boundary conditions of expressive writing should be explored (e.g., [Lumley, 2004](#); [Frattaroli, 2006](#); [O'Connor and Ashley, 2008](#); [Smyth and Pennebaker, 2008](#)). Various theories have been proposed to account for the effects of emotional disclosure (when observed) such as inhibition theory, cognitive processing theory, self-regulation theory and exposure theory (see [Frattaroli, 2006](#)). Central to a number of these theories is the notion that through writing the individual assimilates the stressor into their own self-schema and beliefs system leading to health benefits downstream. However, surprisingly, no research has explored the possibility that some of the null effects previously reported may be explained by variations in the propensity to engage in perseverative cognition. For instance, it is possible that writing about a past stressful or traumatic event may trigger perseverative cognition in some individuals, preventing assimilation of the stressful or traumatic memories, thereby hampering the effectiveness of the writing intervention. If this is the case, it is predicted that levels of perseverative cognition will interact with written stress disclosure such that participants who report a high level of stress-relating thinking (following stress/trauma writing) will exhibit a greater CAR and upper respiratory infection symptoms at follow-up.

In parallel research, another group has shown that asking participants to write about the most positive and happiest experiences of their lives can also have beneficial effects on health outcomes ([Burton and King, 2004, 2008](#)). In an initial study, [Burton and King \(2004\)](#) showed that writing about intensely positive events was associated with fewer health center visits for illness, compared to controls, at three months follow-up. More recently, these authors found a brief positive writing intervention to confer benefits on health complaints 4–6 weeks post intervention ([Burton and King, 2008](#)). Within this context, expressive writing is likely to trigger repetitive thinking about past positive events. Therefore, by including a positive writing condition, the current study offered a unique opportunity to test whether perseverative cognition (i.e., time spent thinking about a past stressful/traumatic experience) and not positive thinking was associated with cortisol awakening responses and upper respiratory infection symptoms at follow-up. Moreover, inclusion of a measure of perseverative cognition in an emotional writing study allowed us to investigate whether increases in stress-related thought (following writing) may interfere with the potential effectiveness of written stress disclosure.

In summary, this study aimed: (i) to explore whether stress-related thinking, triggered by writing about a stressful/traumatic event, is predictive of cortisol awakening responses and upper respiratory infection symptoms and (ii) to examine the efficacy of two writing interventions on these health outcomes

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