

Inhibitory control and symptom severity in late life generalized anxiety disorder[☆]

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Abstract

Contemporary models of generalized anxiety disorder (GAD) posit that worry functions as an avoidance strategy. During worry, individuals inhibit threat-related imagery in order to minimize autonomic reactivity to phobic topics. This conceptualization of worry suggests a role for the executive system in exerting top-down inhibitory control (IC) over threat processing. We tested the hypothesis that better performance on an IC task would be associated with greater severity of worry and concomitant anxious mood. Forty-three older adults (age 60–77) with GAD completed the Stroop color word task and a battery of self-report symptom measures. Fifteen of the GAD patients were paired with age- and sex-matched non-anxious controls. In the full GAD sample, age-normed *t*-scores of Stroop performance were positively correlated with measures of worry and trait anxiety, but not anxious arousal or depression. Positive relationships between IC and symptom severity were upheld in the smaller subsample of GAD patients, while in the matched control group, no relationships between Stroop scores and clinical measures were observed. Patients and controls did not differ in Stroop performance. In the context of a disorder-specific tendency to make maladaptive use of executive functions, better IC may be associated with more severe symptomatology.

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Introduction

Worry as a cognitive avoidance strategy

Generalized anxiety disorder (GAD) is a prevalent and disabling disorder characterized by pervasive, excessive, and uncontrollable worry (American Psychiatric Association, 2001). Contemporary models of GAD emphasize two central features of the condition: the persistence of pervasive and uncontrollable worry, and the notable absence of many of the somatic features (e.g. faintness, heart palpitations, and excessive sweating) that reliably characterize other anxiety disorders (Marten et al., 1994). For example, Borkovec's avoidance theory

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of worry (Borkovec, 1994; Borkovec, Alcaine, & Behar, 2004; Borkovec, Ray, & Stober, 1998) posits that worry is a cognitive avoidance strategy used to decrease discomfort level in the face of anxiety-provoking stimuli. Laboratory studies of voluntary worry have shown that worry is comprised of thoughts, as opposed to images (Borkovec & Inz, 1990), and, in contrast to imaginal processing, is associated with a *reduction* in autonomic nervous system response to fear material both during (Vrana, Cuthbert, & Lang, 1986) and after (Borkovec & Hu, 1990; Peasley-Miklus & Vrana, 2000) worry. Because worry is a successful strategy for the short-term suppression of anxious reactivity, worry is negatively reinforced as a coping tactic (e.g., Mowrer, 1947). However, worry is ultimately maladaptive because its strictly verbal nature precludes the comprehensive emotional processing (e.g., mental imagery, intense feelings of arousal, and imagining the ‘worst outcome’) believed to be necessary for fear extinction (Foa & Kozak, 1986).

In the avoidance conceptualization of worry, avoidance of unwanted emotional/imaginal content is achieved through a selective processing strategy in which attention is directed toward verbal information and away from mental images. In a sense, the behavioral avoidance that characterizes other anxiety disorders is turned inward, necessitating a degree of cognitive dexterity in order to direct attention narrowly and avoid emotional contact with anxiety-provoking stimuli. This selective processing style may require proficiency in the effortful control of attention. During worry, an individual devotes attentional resources to the renumerative linguistic processing of threatening stimuli while holding at bay other demands on processing capacity. Because imaginal representations of the same aversive stimulus are likely to be primed repeatedly during the course of the worry episode (Borkovec et al., 2004), this task may require considerable inhibitory control (IC) of attention in order to maintain top-down attenuation of the fear response.

IC and the neurocognitive substrates of worry

The executive functions governed by the prefrontal cortex (PFC; Fuster, 1997) may play a crucial role in modulating the body’s response to threat during worry. When multiple processing routines are available, it is the role of the executive system to inhibit task-irrelevant processing while directing attentional resources toward task-relevant processing (e.g., Smith & Jonides, 1999). This skill becomes most crucial when the context promotes the retrieval of response tendencies that stand in conflict to the current task. IC or the executive ability to inhibit task-irrelevant processing, may be particularly relevant to the maintenance of GAD symptoms. During an episode of worry, the executive system may impose a strict processing routine that keeps verbal representations of the worrisome topic quickly retrievable while simultaneously inhibiting the activation of threat-related images, even though the conditions of worry (i.e., elaborative processing of a threatening subject) are likely to prime imaginal representations and emotional responding.

Although a role for IC during worry has intuitive appeal, as Borkovec, Alcaine, and Behar (2004) note, the mechanism by which worry accomplishes suppression of somatic reactions has yet to be defined. To our knowledge no work has been done to directly test the role of executive functions in worry. Executive skills, including IC, are known to be implemented primarily by the PFC (e.g., Miller & Cohen, 2001; Smith & Jonides, 1999). Although executive processes and PFC activation are not necessarily synonymous, evidence of PFC recruitment during worry would be expected if IC and worry are indeed closely linked. To date, neuroimaging studies of worry and GAD have been scant; nevertheless, several increases in prefrontal indices have been documented, including increased PFC neuronal integrity (Mathew et al., 2004) and increased PFC activity in GAD patients (Hoehn-Saric, Schlund, & Wong, 2004; Wu et al., 1991) as well as in non-anxious participants who are prompted to worry (Hoehn-Saric, Lee, McLeod, & Wong, 2005).

In contrast to the notion that worry relies on IC, the contradictory assertion that inhibitory *deficits* contribute to GAD pathology has also been made. A substantial body of research documents involuntary attentional biases toward the encoding of threat-related information in anxious individuals, including individuals with GAD (for a review, see MacLeod & Rutherford, 2004). There is presently no consensus regarding the cognitive mechanism that best accounts for these biases (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007). While some theoretical models imply that a primary deficit in controlled, top-down processing abilities such as IC leaves GAD patients with little ability to adaptively modulate threat processing (MacLeod & Rutherford, 1992, 2004), others emphasize the role of early evaluative processes that operate prior to the engagement of higher-order executive functions like IC. For

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