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Sex differences in the indirect effects of cognitive processes on anxiety through emotion regulation difficulties ☆

Joseph R. Bardeen [a,*], Erin N. Stevens [b]

[a] Department of Psychology, Auburn University, Auburn, AL, United States
[b] Department of Psychology, Northern Illinois University, DeKalb, IL, United States

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ABSTRACT

Drawing on a gender roles theory of emotion regulation, we examined the specific facets of emotion regulation difficulties through which higher-order cognitive abilities may be related to anxiety. Participants ($N = 225$) completed self-report measures of emotion regulation difficulties and anxiety, and were administered neuropsychological tests assessing abstract reasoning and inhibition. PROCESS (Hayes, 2012) was used to estimate the direct and indirect effects of both inhibition and abstract reasoning on anxiety symptoms, with six dimensions of emotion regulation difficulties serving as multiple mediators operating in parallel. Results suggest that the relation between higher-order cognitive abilities and anxiety operate through distinct, sex-dependent emotion dysregulation mechanisms. For females, higher levels of inhibition and abstract thinking were associated with poorer clarity of emotions, which in turn, was associated with higher levels of anxiety symptoms. As such, over-attentiveness to, or over-analysis of, emotions may be particularly detrimental among females who have relatively higher abstract reasoning abilities. For males, higher inhibition was associated with greater perceived effectiveness in regulating negative emotions, which in turn, was associated with lower levels of anxiety symptoms. This finding suggests that mood regulation expectancies may be particularly important in understanding the pathogenesis of anxiety in males.

Anxiety disorders are more prevalent than any other mental health disorder in the United States, affecting approximately 18% of the population in a given year (Kessler, Chiu, Demler, & Walters, 2005). In addition to the psychological suffering associated with anxiety, anxiety disorders also result in significant impairments in a variety of domains (e.g., family, social, and occupational functioning), and are predictive of poorer physical health and an overall reduction in quality of life (Hoffman, Dukes, & Wittchen, 2008). Further, anxiety disorders produce a substantial economic burden (e.g., treatment costs, costs associated with employee absenteeism and reduced productivity), with cost estimates exceeding 42 billion dollars per year (Kessler & Greenberg, 2002). Given the staggering levels of human suffering and economic burden that are associated with anxiety disorders, the identification of risk and resiliency factors for anxiety pathology is critically important so that we may ultimately remedy these negative outcomes. Of note, females are diagnosed with anxiety disorders at a significantly higher rate than males (Kessler, Berglund, et al., 2005). Thus, it is also extremely important to consider sex differences in the pathogenesis of anxiety.

One area which has begun to receive increasing attention in the anxiety literature is the study of individual differences in higher-order cognitive processes (e.g., inhibitory control, abstract reasoning), and the degree to which these processes influence the development and maintenance of anxiety (e.g., Bardeen & Read, 2010; Derryberry & Reed, 2002). For example, inhibitory control—the ability to inhibit and override dominant response tendencies in favor of goal-relevant, or subdominant, responding (Rothbart, Ellis, Rueda, & Posner, 2003)—has been suggested as a protective factor against the development of anxiety pathology. Conceptually, it seems that those with relatively higher inhibitory control would be better able to down-regulate dominant, bottom-up, emotional arousal, thus reducing the likelihood of experiencing prolonged negative affective states and subsequent anxiety pathology. However, to date, findings have been equivocal regarding the relation between behaviorally-based measures of inhibitory control (e.g., as measured by the Stroop task; Golden, 1978) and anxiety. For example, in line with the above rationale, Beaudreau and O'Hara (2009) found that inhibitory control was significantly negatively correlated with anxiety symptoms in a community sample

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* Corresponding author at: Department of Psychology, Auburn University, Auburn, AL, 36849, United States. Tel.: +1 585 738 8307.
E-mail address: jbardeen@auburn.edu (J.R. Bardeen).

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of older adults ($N = 102$). In contrast, Price and Mohlman (2007) found inhibitory control to be significantly positively correlated with anxiety and worry among older adults with generalized anxiety disorder (GAD: $n = 43$), though it was not associated with either worry or anxiety among older adults without GAD ($n = 15$).

Price and Mohlman (2007) interpreted their findings as suggesting that deficits in inhibitory control are not associated with increased risk for GAD, but rather, greater levels of inhibitory control may actually increase anxiety by facilitating worry and rumination as a strategy to inhibit, or avoid, the processing of threat-related stimuli. Another possibility, as suggested by Price and Mohlman (2007), is that the observed effects may be the result of other related, but distinct, higher-order cognitive processes (e.g., sequence planning, abstract reasoning) which may be more likely to result in elevated levels of worry and rumination. This suggestion highlights the importance of differentiating between higher-order cognitive processes rather than using any one cognitive process as a proxy for a general executive functioning construct. Thus, equivocal findings in the research literature may be due, in part, to a third variable confound (i.e., other higher-order cognitive processes).

As described, higher-order cognitive abilities have been implicated in the regulation of internal experiences and the development of anxiety. Thus, individual differences in higher-order cognitive abilities may leave one vulnerable to experiencing difficulties in regulating emotion, which in turn, may result in psychological distress. For example, emotion dysregulation has been implicated in anxiety disorders in general (for a review, see Cisler, Olatunji, Feldner, & Forsyth, 2010), posttraumatic stress disorder (Bardeen, Kumpula, & Orcutt, 2013; Ehring & Quack, 2010), depression (Gross & Munoz, 1995), borderline personality disorder (Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006), alcohol dependence (Berking et al., 2011), and a host of other maladaptive outcomes (for a review, see Aldao, Nolen-Hoeksema, & Schweizer, 2010). Interestingly, a number of differences in emotion regulation have been observed between males and females. Males are significantly more likely to use suppression as an emotion regulation strategy than females (Gross & John, 2003). Females, however, are more likely than males to (a) view their emotions as important information, (b) pay attention to and analyze their emotions (Barrett & Bliss-Moreau, 2009; Nolen-Hoeksema, 2012), (c) use rumination in an attempt to regulate their distress (Tamres, Janicki, & Helgeson, 2002), and (d) use higher-order cognitive abilities to a greater degree to regulate negative emotions (McRae, Ochsner, Mauss, Gabrieli, & Gross, 2008), thus leaving females more vulnerable to cognitive resource depletion, especially when experiencing prolonged stress.

The noted findings are consistent with a gender roles theory of emotion regulation which presupposes that males and females adopt differential patterns of emotion regulation on the basis of societal norms. Specifically, cultural mores support emotion suppression in males (Nolen-Hoeksema, 2012), whereas females are customarily viewed as more emotional (Barrett & Bliss-Moreau, 2009), better at identifying emotions, and better at using emotion-related information to appropriately guide their actions (Petrides, Furnham, & Martin, 2004). Given these emotion regulation-related sex differences, one might surmise sex-specific higher-order cognitive mechanisms that underlie emotion regulation. Specifically, for males, who are prone to regulate emotional distress with emotion suppression, inhibitory control may be the dominant emotion regulation-related higher-order cognitive mechanism. For females, who are prone to regulating emotional distress by attending to and analyzing their emotions, abstract reasoning (i.e., the ability to identify patterns and relationships that underlie concrete concepts and extend these patterns and relations to novel problems and situations) may be the dominant emotion regulation-related higher-order cognitive mechanism. Importantly, failing to account for these sex differences in study design may also, at least partially, explain the disparate findings observed in the extant literature.

Moberly and Watkins (2006) describe an abstract evaluative style as being "focused on evaluating the higher-level causes, meanings, consequences, and implications of self experience" (p. 282), which is in contrast to a more concrete, present moment-focused, form of evaluation and problem solving style. An abstract, versus concrete, style has been shown to (a) increase repetitive negative thought (e.g., worry, rumination; Moberly & Watkins, 2006), (b) increase negative mood reactivity to task failure in a laboratory setting (Watkins, Moberly, & Moulds, 2008), (c) reduce the use of problem-solving (Watkins & Moulds, 2005), and (d) potentiate self-reflection even when doing so detracts from goal pursuit (Johnson, Nolen-Hoeksema, Mitchell, & Levin, 2009). Thus, females with relatively higher abstract reasoning abilities may be especially prone to putting substantial effort into analyzing their negative emotional experiences, which may become maladaptive (e.g., self-referential repetitive negative thoughts), and result in psychological distress. Paying an inordinate amount of attention to emotions may actually obscure emotional understanding and reduce the likelihood of using concrete problem solving to determine a course of action for alleviating emotional distress.

Given the equivocal nature of the findings described above, temporal precedence of associations among cognitive processes, emotion dysregulation, and internalizing pathology can be difficult to determine. However, evidence implicates individual differences in inhibitory control, as well as other higher-order cognitive abilities, in the later development of self-regulatory abilities (see Degnan & Fox, 2007), thus suggesting a temporal sequence in which the development of cognitive abilities precedes, and subsequently leads to, variation in self-regulatory abilities. Moreover, there is literature to suggest a temporal relation between emotion regulation abilities and anxiety. For example, in a longitudinal study, Bosquet and Egeland (2006) found that the ability to regulate emotion in response to a frustrating task among children at 42 months of age predicted the development of anxiety symptomatology at 64 months of age. Additionally, related to anxiety pathology, evidence suggests that deficits in effortful control—which broadly includes the higher-order processes of inhibitory control and attentional control—may put individuals at risk for the later development of anxiety pathology (Muris, 2006). And more broadly, intelligence in childhood has been shown to be associated with psychological distress, including anxiety and depressive symptoms, in adulthood (Gale, Hatch, Batty, & Deary, 2009). Gale et al. (2009) suggest that neurocognitive factors may affect one's likelihood of future internalizing pathology.

As described, the discrepant findings surrounding associations between higher-order cognitive processes and anxiety may be due a lack of research on sex differences in this literature. Further, because individual differences in these higher-order cognitive abilities may leave one vulnerable to experiencing difficulties in regulating emotion, which in turn, may result in anxiety, we examined emotion regulation difficulties as the mechanism through which abstract reasoning and inhibitory control lead to anxiety. Mediation models were examined separately for males and females. Based on Gratz and Roemer's (2004) conceptualization of emotion regulation, we examined the specific facets of emotion regulation difficulties that mediate the path from inhibitory control and abstract reasoning to anxiety. Gratz and Roemer's (2004) comprehensive conceptualization of emotion regulation proposes that effective emotion regulation involves the following: identification of emotional experience and differentiation between emotions, acceptance of negative emotions, perceiving oneself as being able to strategically regulate negative emotions, and the ability to purse goal-directed behavior and inhibit impulsive behaviors when