

Executive Function Impairment in ADHD and Generalized Anxiety Disorder

Shimaa Ibrahim Amin, Radwa Mohamed Mohamed Ali Abdelnaby, Eman Roshdy
Elsafy, Lamis Ibrahim Ali

Psychiatry Department, Faculty of Medicine, Zagazig University, Egypt

***Corresponding author:** Radwa Mohamed Mohamed Ali Abdelnaby

Email: rad909090@gmail.com,

Abstract:

Executive functions (EFs)—including working memory, inhibitory control, and cognitive flexibility—are essential for goal-directed behavior and daily functioning. Both Attention-Deficit/Hyperactivity Disorder (ADHD) and Generalized Anxiety Disorder (GAD) have been associated with impairments in these domains, though through different cognitive and neurobiological mechanisms. ADHD is primarily linked to deficits in both “cool” (cognitive) and “hot” (emotional) executive functions, leading to significant functional impairments in academic, occupational, and social domains. In contrast, GAD is commonly associated with disruptions in attentional control and processing efficiency, often due to anxiety-related cognitive interference. Despite established theoretical frameworks, findings regarding EF impairments in GAD remain inconsistent. Moreover, the comorbidity of ADHD and GAD introduces complex interactions, potentially exacerbating or modulating executive dysfunction. Understanding these relationships is crucial for improving assessment and developing targeted interventions.

Keywords: ADHD, Generalized Anxiety Disorder, Executive Functions, Working Memory, Inhibitory Control, Cognitive Flexibility, Attentional Control, Comorbidity

Introduction:

Cognitive flexibility, inhibitory control, and working memory are the three main executive functions (EFs) that have been identified in the literature as being crucial for goal-directed behavior (1). These processes are deemed to be essential for psychological health and day-to-day functioning since they facilitate the control of thoughts, feelings, and behavior (2). Disruptions in EF are likely to cascade into broader impairments across multiple cognitive domains (e.g., attention, memory), which have been observed throughout the literature (3), since EFs are the basis for other cognitive processes (1).

Executive function deficits in individuals with ADHD

These EFs are classified as “cool” and “hot.” The former are linked to the ventromedial prefrontal area and include emotional and motivational processes, while the latter rely on the dorsolateral prefrontal areas and group cognitive processes. The inattentive subtype prioritizes issues with working memory, initiative, planning, order, and monitoring (cool EFs), while the hyperactive/impulsive subtype would be characterized by issues with inhibition, change, and emotional control (hot EFs) (4).

Impact of executive function deficits on daily life

According to Sjöwall & Thorell (5), Patients with ADHD and executive deficits have considerably higher problem levels, mainly with regard to academic achievement, unemployment, criminality, and traffic accidents, according to earlier research examining the relationship between neuropsychological deficits and everyday functioning in clinical samples of adults with ADHD.

When examining neuropsychological deficiencies as a dimension (i.e., from low to high deficits) rather than as a category, similar relationships between executive deficits and everyday functioning have been

discovered. According to some earlier research, there is a higher correlation between executive deficiencies and everyday functioning when self-ratings are used instead of tests. At least one prior study has discovered connections between delay-related behaviors and day-to-day functioning (such as time and money management).

With relation to emotion dysregulation, it is evident that having trouble controlling one's emotions has a detrimental effect on day-to-day functioning and is strongly linked to both ADHD and numerous other mental illnesses. Emotion dysregulation has been associated, among other things, with increased comorbid symptom levels, worse social relationships, increased unemployment, lower educational attainment, more traffic accidents, and a reduced quality of life in clinical investigations of individuals with ADHD.

Regardless of whether they took medication, EF and QoL were found to be significantly correlated in children and adults with ADHD. In particular, **Thorell et al. (6)** discovered that in older adults with ADHD, severe working memory deficiency was strongly associated with a worse life outlook, life productivity, and relationships, whereas inhibitory insufficiency was significantly associated with a worse interpersonal relationship **(7)**.

Impact of GAD on cognitive and executive functioning

GAD has been consistently associated with impairments in 'cold' (non-affective) executive functioning. Theoretical frameworks such as attentional control theory propose that high levels of anxiety impair executive functioning by biasing attention toward perceived threats, thereby reducing the availability of cognitive resources for goal-directed processing and diminishing cognitive control and flexibility **(8)**. According to this theory, anxiety disrupts the balance between the goal-directed (top-down) and stimulus-driven (bottom-up) attentional systems, leading to difficulty shifting attention, suppressing intrusive thoughts, or holding information in mind under emotional stress **(9)**.

Importantly, attentional control theory predicts that anxiety is more likely to impair the efficiency of performance (e.g., slower reaction times, greater mental effort) rather than accuracy, as anxious individuals may compensate by investing additional cognitive effort to maintain performance levels. Neurobiological models further suggest that dysregulation in the amygdala and prefrontal cortex underlies both emotional reactivity and EF disruption in GAD **(3)**.

Despite clear theoretical and neurobiological links, empirical findings on EF in GAD remain inconsistent. Some studies report broad EF impairments, while others show intact functioning or selective deficits limited to specific domains **(10)**.

A recent systematic review of cognitive function in youth with GAD further highlights this variability, finding deficits in non-verbal memory, receptive language, and motor skills but intact attention, visuospatial ability, and inhibitory control ⁽¹¹⁾.

In contrast, other studies have reported poorer attention and inhibitory control in adult samples **(3)**.

These findings reinforce the idea that cognitive performance in GAD may be domain-specific and age-dependent. Moreover, some evidence aligns with attentional control theory, demonstrating that individuals with GAD maintain task accuracy but perform more slowly, reflecting reduced processing efficiency rather than global impairment **(9)**. However, some studies have reported reduced accuracy, contradicting the central tenet of attentional control theory **(12)**.

Given that many GAD interventions aim to target maladaptive cognitive processes **(13)**, a more refined understanding of how GAD affects EFs is essential. A systematic, domain-specific synthesis of existing findings is therefore warranted to clarify whether and how different EF components are impaired in GAD, and to inform the development of targeted interventions grounded in up-to-date empirical evidence.

The impact of comorbidity

Given that it may have significant ramifications for etiology, assessment, and therapy, the comorbidity of ADHD and anxiety disorders (ADHD+AD) necessitates thorough consideration in and of itself **(14)**.

Particularly with regard to executive functions (EF) and inhibitory control, the comorbidity of ADHD and AD appears to be a genuine phenomenon that cannot be well explained by symptom overlap alone (15).

The authors came to the conclusion that AD may exacerbate working memory impairments and partially regulate impulsive and response inhibition deficiencies in ADHD (16).

Although ADHD is defined as a disease with decreased inhibition control (17), AD is linked to increased inhibition control (18) and may contribute to lessening the intensity of ADHD symptoms (19).

According to the theoretical framework (7), ADHD is typified by low behavioral inhibition system activity, which results in impulsive, quick responses and inadequate inhibitory control. In contrast, the behavioral inhibition system is overactive in AD (20), which results in improved inhibitory control and thoughtful and sluggish responses. Following this line of inquiry, a study (21) in adults discovered that anxiety is linked to both more omissions for the expected answers and higher performance when response inhibition is needed.

However, research on EF shows mixed results on whether children with ADHD+AD have superior inhibitory control than children with ADHD without anxiety disorders (ADHD-AD). Children with ADHD+AD had better behavioral inhibition than children with ADHD-AD, according to a number of research (7), however other investigations have not supported these findings.

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