

# Neuropsychological deficits in internalizing and externalizing disorders: Implications for improving cognitive-behavioral therapy in children and adolescents

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## Abstract

Over the past three decades, our understanding of the nature, assessment and treatment of childhood mental disorders has increased significantly. Some of the most recent advances come from transdiagnostic and neuropsychological-based approaches. While the relationship of similar neuropsychological deficits with some mental disorders, such as neurodevelopmental and severe mental disorders like schizophrenia or bipolar disorder, is widely established, there is more controversy about their relationship with the so-called internalizing and externalizing disorders. In this article, our goal was to highlight the potential of incorporating cognitive strategies from integrative neuropsychological and transdiagnostic approaches to improve the effectiveness of empirically-supported cognitive-behavioral therapy for internalizing and externalizing mental disorders in childhood and adolescence. The results of the present work indicate that the vast majority of internalizing disorders, including the presence of anxiety, depressive, trauma- and stress-related, and obsessive-compulsive and related disorders, as well as externalizing symptoms (corresponding to conduct disorder and ODD), present neuropsychological deficits and that their consideration may be relevant to improve the effectiveness of psychotherapeutic interventions in children and adolescents by incorporating neuropsychology-based assessment and treatment tools. The inclusion of neuropsychological support strategies in therapy for childhood mental disorders implies an advance and has clear implications for the enhancement of psychological care for childhood mental disorders.

**Keywords:** neuropsychology, mental disorders, internalizing, externalizing, children and adolescents.

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## **Défices neuro-psicológicos nas perturbações internalizantes e externalizantes: Implicações para aumentar a eficácia das intervenções cognitivo-comportamentais em crianças e adolescentes**

### **Resumo**

Ao longo das últimas três décadas, a nossa compreensão da natureza, avaliação e tratamento das perturbações mentais na infância aumentou significativamente. Alguns dos avanços mais recentes derivam de abordagens transdiagnósticas e neuropsicológicas. Embora a relação de défices neuropsicológicos com algumas perturbações mentais, como as perturbações neurodesenvolvimentais e perturbações mentais graves, como a esquizofrenia e a perturbação bipolar, seja amplamente reconhecida, existe maior controvérsia acerca da sua relação com as perturbações internalizantes e externalizantes. Este artigo teve como objetivo destacar o potencial de incorporar estratégias cognitivas derivadas de abordagens transdiagnósticas neuropsicológicas integradoras para aumentar a eficácia de tratamentos cognitivo-comportamentais empiricamente validados para perturbações internalizantes e externalizantes na infância e na adolescência. Os resultados do presente trabalho indicam que tanto a vasta maioria de perturbações internalizantes (incluindo perturbações de ansiedade, perturbações depressivas, perturbações relacionadas com trauma e fatores de stress, e perturbações obsessivo-compulsivas e relacionadas) como perturbações externalizantes (como perturbação do comportamento e perturbação desafiante de oposição), apresentam défices neuropsicológicos, e que a consideração destes défices pode ser relevante para melhorar a eficácia de intervenções psicoterapêuticas com crianças e adolescentes, incorporando ferramentas neuropsicológicas de avaliação e tratamento. A inclusão de estratégias neuropsicológicas de suporte na intervenção terapêutica para as perturbações mentais infantis implica um avanço e tem implicações claras na melhoria de cuidados psicológicos a esta população.

**Palavras-chave:** neuropsicologia, perturbações mentais, internalizantes, externalizantes, crianças e adolescentes.

## **INTRODUCTION**

The global prevalence for mental disorders in children and adolescents ranges from 6% to 20% and is clearly increasing. For example, Erskine et al.'s (2017) study reported a mean global prevalence of 6.7% for mental disorders in ages 5-17 years, whereas Polanczyk et al. (2015) reported a worldwide-pooled prevalence of mental disorders of 13.4% (95% CI [11.3, 15.9]). Specifically, the prevalence for anxiety

disorders worldwide is about 6.5% (95% CI [4.7, 9.1]), 2.6% (95% CI [1.7, 3.9]) for any depressive disorder, 3.4% (95% CI [2.6, 4.5]) for attention deficit hyperactivity disorder (ADHD), and 5.7% (95% CI [4.0, 8.1]) for any disruptive, impulse control, or conduct disorder (Polanczyk et al., 2015). Erskine et al. (2017) reported rather similar prevalence rates: anxiety: 3.2%; depression: 6.2%; ADHD: 5.5%; and conduct disorder: 5.0%. Furthermore, these prevalence rates differ according to gender, as anxiety disorders are more common among girls, and ADHD among boys, and girls have a greater risk for developing schizophrenia, obsessive-compulsive disorder (OCD), and mood disorders (Dalsgaard et al., 2020).

All these data indicate that mental disorders affect a significant number of children and adolescents worldwide. This high rate is even more alarming when we realize that children and adolescents up to the age of 19 represent one third of the world's population (United Nations [UN], 2019). If left unchecked, these problems can severely influence children's development and, consequently, a society that is aging as a whole (Kassebaum et al., 2017; UN, 2019).

The most common practice in the study of childhood mental disorders has been to extrapolate adult models of psychopathology, assessment, and treatment to children. However, developing children represent a unique population for which there are different conceptual, methodological, and practical considerations regarding psychopathology, classification, assessment, diagnosis, and treatment.

In recent years, and partly motivated by this high prevalence, our understanding of the nature, assessment, and treatment of childhood mental disorders has increased markedly, as indicated by the publication of numerous specific manuals (e.g., Lasprilla et al., 2018; Ollendick et al., 2018).

One of the advances with considerable empirical support has been the knowledge of which treatments for mental disorders are effective, with several meta-analytic and umbrella reviews indicating medium to large effect sizes (e.g., Andersson et al., 2019; David et al., 2018). However, these and other studies indicate that psychological treatments of mental disorders for children have been subordinate and dependent on those implemented in adults, so this assumption has made it difficult to obtain greater evidence of the effectiveness of psychological treatments in children and adolescents from a scientific point of view (Cano-Vindel & Moriana, 2018).

Among the treatments with the most empirical support in the treatment of mental disorders for children and adolescents are those with a cognitive-behavioral and psychoeducational approach, which is considered the first-line treatment (Bekker et al., 2017). However, the effect sizes on outcomes are smaller compared to other interventions: between small and medium for depression and post-traumatic stress disorder, medium for anxiety, and large for OCD (David et al., 2018; Galvez-Lara et al., 2018); there is a considerable percentage of children and adolescents who

do not benefit from the interventions (i.e., between 30-40% for the treatment of childhood anxiety disorders according to Sandin et al., 2018) and the limited scope of psychotherapy (Jorm et al., 2017).

Consequently, this implies considering advances from clinical child psychology and child and adolescent psychiatry and from related disciplines that, through complementary or coadjutant interventions, allow improving the effectiveness of Cognitive-Behavioral Therapy (CBT). Two advances deserve more attention: the transdiagnostic approach for the treatment of mental disorders and the neuropsychological approach applied to child clinical psychology.

In this manuscript, we present, from a neuropsychological approach, a review of the present neuropsychological deficits and the therapeutic strategies that can be effective to improve and complement the CBT of internalizing (anxiety, depression, post-traumatic stress, obsessive-compulsive and related disorders) and externalizing (exclusively, conduct and ODD) disorders in childhood and adolescence. Consequently, this paper aims to describe and discuss the implications of neuropsychological alterations or deficits present in internalizing and externalizing disorders in children and adolescents in order to improve cognitive-behavioral therapy. Thus, it will focus on analyzing the following aspects from a neuropsychological approach: a) some of the latest advances in explanatory models that explain the presence of these deficits and that can improve psychological therapies; b) neuropsychological deficits according to the disorder or predominant symptoms; and c) the main therapeutic strategies that can be effective to improve and complement the more traditional CBT of mental disorders in childhood, especially internalizing and externalizing disorders.

## **ADVANCES FROM CLINICAL CHILD PSYCHOLOGY AND RELATED DISCIPLINES THAT CAN IMPROVE PSYCHOLOGICAL THERAPY**

In psychopathology and clinical psychology, there is still controversy about which diagnostic approach best fits mental disorders: dimensional (e.g., Achenbach, 1985) versus categorical (e.g., Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> edition - DSM-5, American Psychiatric Association [APA], 2013). Therefore, the categorical approach to psychopathology considers that there are specific mental disorders that can be well defined by a set of symptoms, specific to each disorder (Cano-Vindel & Moriana, 2018). On the other hand, the dimensional approach states that the disorders themselves are really independent dimensions or behavioral traits, and that all children have them in different degrees, grouping them

in two large blocks: problems due to a low control or externalizing problems, and problems due to a high control or internalizing problems, following Achenbach's classification (1985). Thus, on the one hand, internalizing symptoms correspond to manifestations of anxious, depressive, and somatic problems, as well as problems of withdrawal. Consequently, anxiety, depression, stress- and trauma-related and obsessive-compulsive and related disorders, according to DSM-5 criteria (APA, 2013), have been included in this review. On the other hand, we included externalizing symptoms, which refer to problems related to aggressive behavior, disobedience, and criminal judicial behavior corresponding to conduct disorder and ODD, following the DSM-5 classification (APA, 2013).

A third block would be the combined syndromes, which include social, thinking, and attention problems. Some of the problems of the categorical approach are the excessive increase of diagnostic categories and the high comorbidity, which may imply limited validity for these disorders. The dimensional model has also received criticism and, as a main disadvantage, is less pragmatic and less clear for its application in the clinic (Sandin et al., 2012).

### *Transdiagnostic perspective*

In this context, an integrative alternative to the two classical models has emerged, the "transdiagnostic" approach to psychological emotional problems, a relatively new approach that starts from a comprehensive conception of the symptoms that several disorders have in common. Although the term transdiagnostic was initially used by Fairburn et al. (2003) in the field of eating disorders, its use has spread to other disorders, primarily internalizing disorders (depressive, anxiety, and somatization disorders), where many of the symptoms that appear in the course of these problems are common to each other and would explain the high comorbidity between them. From the psychopathological point of view, transdiagnostic approach consists of understanding mental disorders on the basis of a range of etiopathogenic cognitive and behavioral processes that are common to most mental disorders (Sandin et al., 2012).

The main application of these models has been the development of interventions to improve the effectiveness of psychotherapy. Transdiagnostic treatments can be applied both in individual and group formats, and usually include a first component focused on psychoeducation about emotions and factors involved in emotion regulation, especially the role of cognitive distortions (magnification, over-attention, rumination) and the use of avoidance or similar anxiety-reducing behaviors. Its effectiveness has been widely demonstrated in adults and young

people, and adaptations are currently being made for children (Cano-Vindel & Moriana, 2018; Garcia-Escalera et al., 2016). Thus, several studies have found that unified transdiagnostic protocols for anxiety and mood disorders were as effective as specific treatments in terms of symptom improvement, although they additionally achieve improvement in the symptoms of comorbid disorders and in a more efficient way (Garcia-Escalera et al., 2016; Mansell, 2019; Newby et al., 2015).

### *Neuropsychological perspective*

Until relatively recently, psychopathology and clinical psychology versus neuropsychology had walked in separate, reductionist and mutually exclusive fields of knowledge. However, in the last 15 years, some authors have advocated the integration of the two fields of knowledge to improve intervention in mental disorders (Harvey et al., 2014; Harvey et al., 2004; Tirapu-Ustarroz, 2011; Tirapu-Ustarroz & Muñoz-Cespedes, 2004).

This integration of clinical psychology and neuropsychology could favor the effectiveness of clinical interventions by examining the cognitive deficits related to mental disorders to determine the impact of these deficits on functional aspects of behavior and, on the other hand, by describing these deficits so as to enable intervening in them to improve the person's health and well-being. In this way, mental disorders could be explained in terms of structural or functional alterations of brain activity (neuropsychology of mental disorders) and provide clinical psychology with a discourse more in line with our current knowledge of the brain (Tirapu-Ustarroz & Muñoz-Cespedes, 2004).

Several authors have pointed out the interest in incorporating knowledge about neuropsychology to improve the assessment and treatment of mental disorders (Tirapu-Ustarroz, 2011; Tirapu-Ustarroz & Muñoz-Cespedes, 2004). Thus, various studies focusing on the neuropsychology of mental disorders coincide in pointing out the existence of neuropsychological alterations in different mental disorders, such as the so-called neurodevelopmental disorders (APA, 2013, pp. 31-32; Thapar et al., 2017) and, in severe mental disorders, such as schizophrenia, bipolar disorder, and some personality disorders such as antisocial personality disorder (APA, 2013; Bedoya-Tovar et al., 2011; Frias et al., 2015; Tirapu-Ustarroz & Muñoz-Cespedes, 2004).

However, there is more controversy about the relationship and role of neuropsychological deficits in internalizing or emotional disorders, such as anxiety or depression, and in purely externalizing disorders, such as conduct disorders.

## NEUROPSYCHOLOGICAL CHARACTERISTICS OF MENTAL DISORDERS

As pointed out above, the idea of incorporating the advances of neuropsychology into child psychotherapy has emerged recently. Thus, child or developmental neuropsychology is a field of research that has been expanding rapidly in recent decades. It is a discipline of behavioral neuroscience that studies the relationships between behavior and the developing brain in order to apply scientific knowledge of these relationships to evaluate and compensate the consequences of brain injuries produced in childhood (Portellano, 2007). The characteristics and typical neurocognitive profiles of different mental disorders can help to identify a problem and design the best possible interventions.

The main cognitive functions that can be considered in child neuropsychological assessment are those listed below in Tables 1 and 2. Table 1 describes the main cognitive functions that can be assessed following Portellano (2007, chap. 11), and Table 2 describes the executive functions (EFs) according to the model proposed by Tirapu-Ustarroz et al. (2017, 2008, 2005).

**Table 1**  
*Definition of some of the main cognitive functions*

Function	Description	Involved brain areas
Intelligence (IQ)	General capacity of the person to act with a purpose, to think rationally and to interact effectively with his/her environment; capacity of abstraction and reasoning; includes both the verbal comprehension factor and perceptive reasoning; index of general capacity or G-factor of intelligence (resistant to deterioration and stable over time); includes crystallized, fluid.	Multiple neural networks, with special emphasis on the prefrontal cortex (PFC)
Attention	Mental ability to select stimuli, responses, memories, or thoughts that are relevant, focus on them, and ignore those that are not; different types are recognized, such as alert, focused, sustained (vigilant), selective, alternating, or split.	Reticular system; posterior and anterior attentional system (PFC and subcortical); white substance; frontoparietal circuit
Processing speed	Rhythm with which the brain processes information.	White substance; frontoparietal circuit

**Table 1**  
*Definition of some of the main cognitive functions (cont.)*

<b>Function</b>	<b>Description</b>	<b>Involved brain areas</b>
Memory	Ability to enter, record, store, and retrieve information from the brain, whether values or visual or auditory memories, basic to learning and thinking; impression, retention, and reproduction of a previous experience; ability to retrieve previously learned information at a given time; includes different types: verbal memory (remembering words, stories, etc.) or visual memory (remembering images, figures, etc.).	Temporal cortex
Perceptual organization	Ability to integrate perceptual information.	Parietal cortex
Sensory perceptual (gnosis)	Visual, auditory, and tactile functions.	Cortex (behind Rolando's fissure: parieto-temporal-occipital association areas)
Motor	Gross and fine motor skills, execution of praxis, muscle tone, motor fluidity, and balance.	Cerebral, subcortical, and cerebellar cortexes
Language	Expressive language, understanding, repetition, naming, pragmatics, reading and writing.	Left frontal and temporal cortex
Affective-Behavioral	Emotional, personality, and behavioral problems.	Limbic system (amygdala, hippocampus); limbic-cortical connections; and PFC (dorsolateral, cingulate and orbitofrontal)
Executive functions	Set of cognitive functions that allow us to organize behavior to reach a goal, adapting to the changes and demands of the environment.	Frontal cortex (dorsolateral, cingulate and orbitofrontal), among other structures



**Table 2**

*Model of executive functions (based on the proposed protocol for the evaluation of executive functions by Tirapu-Ustarroz et al., 2017, 2008, 2005)*

Function and description	Subfunctions	Involved brain areas
<b>Processing speed*:</b> amount of information that can be processed per unit of time, or speed at which a series of cognitive operations can be performed.		White substance; frontoparietal circuit
<b>Working memory**:</b> ability to keep information online in the mind and to manipulate it, operate on it, repeat it...	Phonological loop (immediate verbal memory)	Posterior parietal cortex
	Visuospatial sketchpad (immediate visual memory)	Left temporal cortex
<b>Supervisory Attentional System (SAS) or Central Executive System (CES):</b> is activated when a situation is recognized as novel or non-routine, so it is necessary to put into action executive processes of anticipation, goal selection, planning, and monitoring.	Coding and maintenance (when “slave systems” are saturated they go into action)	Dorsolateral prefrontal cortex (DPFC)
	Maintenance and updating (ability of SEC/SAS to update and maintain information)	Ventrolateral prefrontal cortex (VPFC)
	Maintenance and handling (ability of SEC/SAS to maintain and manipulate information)	DPFC
	Dual performance (performing two tasks simultaneously, usually one verbal and one visuospatial)	DPFC; Medial frontotemporal cortex (MFTC)
	Inhibition (ability to inhibit irrelevant stimuli or control interference and distractors). Tasks measuring response inhibition/inhibitory control may detect inhibition problems, as does increased reaction time	Anterior cingulate cortex; orbital PFC; inferior frontal gyrus

**Table 2**

*Model of executive functions (based on the proposed protocol for the evaluation of executive functions by Tirapu-Ustarroz et al., 2017, 2008, 2005) (cont.)*

Function and description	Subfunctions	Involved brain areas
	Semantic and phonological access (through verbal and picture fluency tasks), the ability to access the retrieval of information from semantic memory and the activation of executive processes to perform appropriate strategies to seek words.	Right DPFC; right MFTC
	Cognitive alternation or flexibility (includes processes of maintenance, inhibition and updating of cognitive sets or criteria)	DPFC; Medial Prefrontal Cortex (MFPC); Supramarginal gyrus; corpus striatum
	Branching or multitasking paradigms (process that integrates working memory and attention resources to achieve activities of greater complexity than dual or other tasks)	Rostral pole (area 10)
<b>Planning:</b> includes good functioning of working memory and SAS/CES functions, setting a goal, carrying out a mental test, applying the chosen strategy and assessing whether or not the intended objective has been achieved. It includes planning, programing, and self-regulation.		Right DPFC; posterior cingulate cortex, basal ganglia
<b>Decision-making:</b> integration of reasoning processes with emotional states to make appropriate decisions		Ventromedial PFC; DPFC; Insula; Amygdala

\* It would not be considered a cognitive process as such, but rather a property of the system (Tirapu-Ustarroz et al., 2017).

\*\* Although the working or operational memory cannot be considered an “executive process”, it is closely related to these processes, as they are “slave” systems that provide information to the supervisory care system or central executive system to work with that information.

It is worth mentioning that there seem to be altered patterns of cognitive functioning in all disorders, regardless of whether the more general or more specific psychopathological dimensions are considered (see the Supplemental document with the list of studies considered in this review). Overall, the relationship that has received the most empirical support is that which refers to the existence of problems or deficits in EFs in the group of externalizing problems (Oré-Maldonado, 2018) versus the group of internalizing problems or both types of symptoms (Johnson, 2014).

Among the studies linking EFs and externalizing behaviors, Oré-Maldonado (2018) concluded that the worse the performance in inhibitory control tasks, the more dissociative behaviors were found. In Spain, Romero et al. (2016) found a relationship between higher aggressive behavior and poorer performance in executive tasks. Children with oppositional defiant disorder (ODD) show poorer performance in graphic skills, linguistic comprehension, metalinguistic skills, conceptual skills, deferred verbal memory, verbal fluency, cognitive flexibility and planning-organization (Fonseca-Parra & Rey-Anaconda, 2013).

On the other hand, internalizing disorders in children and adolescents have been largely forgotten in the main manuals of child neuropsychology. In part, this has been due to the fact that they are not considered neurodevelopmental disorders with clear neurological determinants. However, there is sufficient accumulated scientific evidence to justify the importance of neuropsychology in these problems, although to a lesser extent, and there are also studies that contradict the significant relationship between internalizing symptoms and neuropsychological deficits (Argumedos et al., 2018; Favre et al., 2008; Utria et al., 2011; Vilgis et al., 2015).

A recent study highlights that several neurodevelopmental disorders, even though they are independent diagnostic entities, share common manifestations to those presented by people with brain damage or dysfunction in the prefrontal cortex. The problems that share these manifestations include child abuse, behavioral disorders, and also anxiety disorders (Herreras et al., 2019).

Lundy et al. (2010) found significant negative correlations between anxiety/depression symptoms and general intellectual function, language, visual construction skills, attention, processing speed, executive functioning skills, aspects of learning and memory, psychomotor coordination, and basic academic skills. There are currently many studies exploring EF deficits in internalizing disorders. A recent review has established relationships between deficits in cognitive flexibility and verbal memory and symptoms of anxiety and depression (Iorfino et al., 2016). Mullin et al. (2020) revealed a relationship between the most deficient EF skills reported by parents and the severity of anxiety and depression symptoms, as well as of externalizing symptoms. In the same line, Nelson et al. (2018) concluded that early EF deficits may be an important risk factor for the development

of internalizing psychopathology in childhood. Consequently, it can be concluded that the assessment of neuropsychological performance should be considered in those children who manifest anxious and/or depressive symptoms.

Specifically regarding depression, a recent meta-analytic review found cognitive deficits such as phonemic verbal fluency, sustained attention, verbal memory and planning in children and adolescents with major depressive disorder (MDD) (Wagner et al., 2015). Depressed children and adolescents have EF problems (Evans et al., 2016), problems with EFs and impulsivity (Maalouf et al., 2011), EFs, processing speed, and memory (Brooks et al., 2010), attention, semantic and logical memory problems (Delgado & Valencia, 2012), problems with EFs and attention and working memory (Baune et al., 2012; Baune et al., 2014), and problems with attention and emotional reactivity (Bloch et al., 2013). Depressed adolescents also show deficits in attention (Günther et al., 2011) and memory (Afzali et al., 2018; Matthews et al., 2008). Franklin et al. (2009) also reported the association between visuospatial working memory and dysthymic disorder in pre-pubertal children. All these results highlight the importance of EFs in adolescent depression, and more generally, in adolescent psychopathology (Holler et al., 2014; Kavanaugh & Holler, 2014).

With regard to anxiety disorders in children and adolescents, anxiety symptoms may be associated with reduced language skills and cognitive flexibility (Toren et al., 2000). In a recent study, Franklin et al. (2018) indicated that high anxiety was associated with reduced self-regulatory EFs. In panic disorder, reviews indicate that there is some evidence that people with panic have problems with short-term memory (O'Sullivan & Newman, 2014). Regarding social phobia, patients show deficits in visual (Vasa et al., 2007) and verbal memory (O'Toole & Pedersen, 2011). The visuospatial attention deficits for the obsessive-compulsive disorder (OCD) group are partially consistent with studies of OCD in adults indicating deficits in visuospatial memory (Chang et al., 2007; Martínez-González & Piqueras, 2008). Additionally, children with OCD have deficits in cognitive flexibility and planning ability (Ornstein et al., 2010), and in EFs and visual memory (Lewin et al., 2014). In contrast, in a recent meta-analytic review, Abramovitch et al. (2015) indicate that young people with OCD do not exhibit significant neuropsychological deficits.

In stress- and trauma-related disorders, the cognitive profile of people who have had PTSD is controversial, as it is not clear whether the memory deficits can be attributed to stress-related disorders or are simply cognitive deficits (Bandelow et al., 2017). In a recent study, Barzilay et al. (2019) found that exposure to post-traumatic stress in young people from non-clinical populations is substantially associated with more severe psychopathology and neurocognitive deficits in all domains, beyond PTSD and depression. In the same vein, Li et al. (2019) confirmed the correlation between PTSD and executive dysfunction in children, even after

considering possible individual differences. A meta-analysis concluded general deficits in EFs in trauma-exposed children and adolescents compared to healthy controls. They also found poorer cognitive performance than controls in general, verbal, and visuospatial intelligence, information processing, learning and memory skills (Malarbi et al., 2016).

## EVIDENCE IN FAVOR OF NEUROPSYCHOLOGICAL-BASED PSYCHOTHERAPY FOR MENTAL DISORDERS IN CHILDREN AND ADOLESCENTS

Regarding the effectiveness of treatment of mental disorders in children and adolescents, diverse sources of evidence support the links between psychotherapy and neuropsychology for mental disorders.

Firstly, various studies have found that comprehensive or combined intervention, which includes both neuropsychological rehabilitation and CBT, has positive effects both on mental and neurological problems in adults (e.g., Martínez-González & Piqueras, 2015; Martínez-González et al., 2013, respectively). This can be considered as empirical support for the usefulness of neuropsychology for the clinical psychological treatment of mental disorders in children and adolescents.

Secondly, one of the most surprising findings has been the effectiveness of psychological intervention by examining changes at the neuropsychological, neuroanatomical, and neurofunctional levels. That is, apart from achieving change at the level of widely contrasted clinical symptoms (Child Mind Institute, 2017), exclusively psychotherapeutic interventions produce changes in brain metabolic activity measured by neuroimaging in people with internalizing mental disorders (anxiety and depression) (Barsaglini et al., 2014; Martínez-González & Piqueras, 2010; Marwood et al., 2018; Sankar et al., 2018), as well as changes in neuropsychological functioning (e.g., Martínez-González et al., 2015). Furthermore, this point is even more important because, as indicated by authors such as Evans et al. (2014), cognitive deficits are associated with deterioration in psychosocial functioning and, therefore, treatments should address not only clinical symptoms, but also neuropsychological and psychosocial functioning.

Because different studies highlight the limited scope and quality of the treatments (Jorm et al., 2017), some authors propose specifically treating cognitive deficits in order to improve them and achieve better therapy outcomes. Thus, for example, a recent study found that CBT did not produce changes in memory and executive functions, so these variables were interpreted as traits rather than as states or a consequence of clinical symptoms (Vandborg et al., 2015). In this sense,

several authors point out that it is feasible to improve well-established psychological treatments by improving memory and learning through cognitive and educational techniques (Harvey et al., 2014). In other words, it would be a matter of using cognitive support strategies to improve the effects of classic CBT.

Finally, a recent study points out that the biases and cognitive deficits so prevalent in anxiety disorders and depression have not been sufficiently addressed by traditional treatments. Hence, the authors suggest that focusing treatment on the major biases and deficits could be strategies to improve treatment effectiveness (Gold et al., 2016).

## NEUROPSYCHOLOGICAL SUPPORT STRATEGIES TO IMPROVE THE EFFECTIVENESS OF EMPIRICALLY-SUPPORTED PSYCHOLOGICAL THERAPY

### *Integrative neuropsychological and transdiagnostic perspective*

Among the few scientific approaches that have attempted to incorporate knowledge from the neuropsychological and neurocognitive fields into psychological therapy is Gillberg's work (2010, 2019) on Early Symptomatic Syndromes Eliciting Neurodevelopmental Clinical Examinations (ESSENCE). Gillberg's (2010, 2019) ESSENCE approach, although focused on neurodevelopmental disorders, is, in our opinion, one of the main exponents of a new transdiagnostic neuropsychological perspective, and shows potential applications for psychological therapy with children and adolescents. Thus, this author points out that the vast majority of children under the age of four with neurodevelopmental problems show common alterations, as demonstrated by the very high comorbidity among these disorders, a large overlap of symptoms and cognitive dysfunctions, etc. These alterations or common elements are alterations in general development, communication and language, social interaction, motor anomalies, inattention, hyperactivity/hypoactivity, behavioral problems, mood regulation problems, eating problems, and sleep disturbances. Although this new perspective has focused on the so-called neurodevelopmental disorders, and not on other problems such as emotional or behavioral disorders, it seems obvious that the approach resembles other approaches from transdiagnostic and clinical psychology that consider some transdiagnostic processes, such as sleep, eating,

emotion regulation, psychomotricity, etc. as key factors for child development. They also consider that these variables underlie the onset and development of neurodevelopmental disorders and also the commencement of internalizing and externalizing disorders occurring in developing children who may share many of these maturity deficits.

The second particularly relevant scientific proposal that has sought to integrate neuropsychology and psychological therapy is the new transdiagnostic approach of Harvey et al. (2004), which proposes the existence of a range of etiological cognitive and/or behavioral processes shared by various psychological disorders; that is, processes that are elevated in a wide range of psychological disorders, which contribute causally to the development and/or maintenance of the symptoms associated with these disorders. The approach focuses specifically on alterations in cognitive or neuropsychological processes - such as attention, memory, reasoning, cognition, and behavior -, which are common to most mental disorders, both emotional and behavioral. The aim of this work was to try to systematize the psychological processes that could be involved in the main and most common mental disorders, in order to develop a global form of transdiagnostic CBT.

Harvey et al. (2004) isolated 14 transdiagnostic processes associated with five key cognitive domains: attention, memory, reasoning, thought, and behavior. The 14 processes were: external selective attention, internal selective attention, and attentional avoidance (attention); explicit selective memory, recurrent memory, and overgeneralized memory (memory); interpretive biases, expectation biases, and emotional reasoning (reasoning); recurrent negative thinking, positive and negative metacognitive beliefs, and thought suppression (thought); and avoidance and safety behaviors (behavior) (Harvey et al., 2004). More recently, with the aim of including neuropsychological strategies to improve the effectiveness of CBT, these authors published a paper entitled "Improving outcome of psychosocial treatments by enhancing memory and learning" (Harvey et al., 2014), in which they suggest and exemplify cognitive strategies to improve the effectiveness of CBT through strategies that would improve memory and learning such as:

1. Attention Recruitment. Therapists should reduce the division of attention during encoding and should develop ways to recruit and scaffold attention onto the encoding of the therapy points.
2. Categorization of reality. Therapists should help their patients better learn and remember by using tools that help categorize multiple therapy points based on common themes/principles, for example, linking information to meaningful fragments will increase recall.

3. Evaluation of the alternatives. A potentially powerful tool that therapists could use is to encourage the patient to generate, compare, and evaluate a variety of different responses to situations, strategies or examples of behaviors.
4. Application of learning to other contexts or similar situations. The aim of application is to explicitly link abstract principles to specific cases to guide people to see the specific situations in which they will have to apply the knowledge. Specific types of application include problem-oriented learning or presenting therapy points in terms of how patients can solve specific problems they encounter in their lives, and using problem solving to evoke past knowledge.
5. Repetition or practice remembering. There is clear and strong evidence that repetition helps to automate new knowledge and that distributed or spaced repetition is much more effective in the learning process than mass learning. Repetition of therapy points may involve the therapist's repeating, reformulating, summarizing, or revisiting therapy points.
6. Cue-based reminders. Practicing mnemonics encourages faster encoding and recovery. Therefore, the use of mnemonics helps the patient develop methods for remembering key therapy points.
7. Praising recall. Classic experiments in the behavioral tradition have clearly demonstrated that providing positive consequences for a behavior increases the likelihood of that behavior. Perhaps reinforcements, such as praise for successfully recalling information discussed in therapy or implementing a therapy point, could reinforce the use of remedial practice and thus promote better learning.
8. Paying attention to transdiagnostic variables such as sleep and physical exercise, which are known to improve memory and learning.

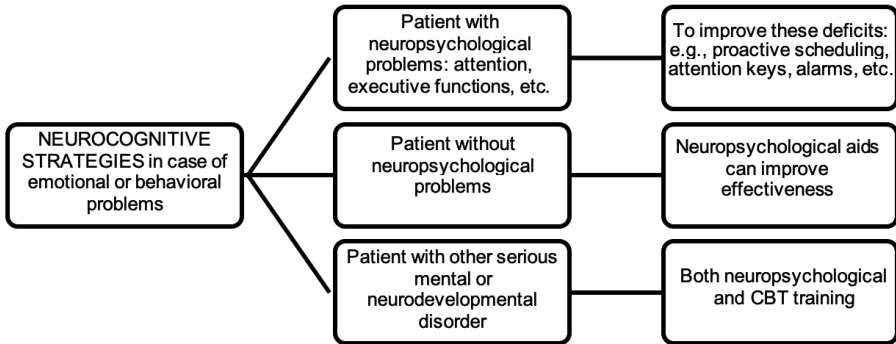
Another interesting approach from the neuropsychological point of view is that proposed by Aldao et al. (2010). These authors related some of the strategies of emotion regulation — that is, the way in which individuals manage (regulates) their own emotions — to various internalizing (anxiety and depressive disorders) and externalizing (addictions and eating disorders) disorders. Recent studies highlight the important role of emotion regulation in explaining the relationship between EF and depressive symptoms and suggest that clinical interventions targeting emotion regulation skills may provide a strategy for the prevention and treatment of depression (Wante et al., 2017).

Finally, apart from a few specific proposals that have attempted to integrate child neuropsychology and CBT, we propose in Figure 1 the following decision tree when trying to improve CBT with neuropsychological or neurocognitive strategies.



**Figure 1**

Decision tree in the use of neurocognitive strategies in CBT



In summary, the neuropsychology of internalizing and externalizing mental disorders is an expanding field, which has received less attention than neurodevelopmental disorders and severe mental disorders with a longer neuropsychological tradition. However, in the next few years, an exponential growth is expected in this field, which will lead to greater knowledge of the etiology and neuropsychological maintenance of these so-called internalizing and externalizing disorders, as well as to a greater number of neuropsychology-based assessment and treatment tools aimed at improving the effectiveness of empirically-supported psychosocial interventions and the prognosis of these disorders.

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