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Executive Functions and Quality of Life in Neurodevelopmental Spectrum. An Outline

Theodoratou¹, M., Gkintoni², E., Farmakopoulou³, I.

¹Hellenic Open University, Greece, ²University of Ioannina, Greece, ³University of Patras, Greece

evi.gintoni@uoi.gr

Abstract. Neurocognitive functions play a decisive role in neurodevelopmental disorders affecting the quality of life of individuals with corresponding diagnoses or clinical indications. In addition, the parameter of executives and their subcategories, such as cognitive flexibility, working memory, and inhibition, as well as the possibility of their optimization through special treatment and training, have been extensively studied in the literature over the past several decades. The purpose of this paper is to present the findings of a decade's worth of review studies on executive functions and quality of life in developmental spectrum disorders. Given the genetic heterogeneity and polymorphism of the neurodevelopmental disorder profile and the overlap of outcome parameters, the findings of review studies must be more consistent in explaining causal factors and the efficacy of interventions. Nonetheless, innovative therapeutic approaches and their individualization hold promise for bridging this gap, with the aim of enhancing the quality of life for individuals in this diagnostic category and their close relatives.

Keywords. Executive Functions, Educational Praxis, Cognitive Psychology, Neurocognition

1. Introduction

Autism spectrum disorder is characterized by deficits in communication, social interaction, and restricted and repetitive behavior patterns. Autism spectrum disorder is approximately 1% prevalent worldwide, while attention deficit hyperactivity disorder affects approximately 6% of children, with inattention, hyperactivity, and impulsivity being the primary symptoms. The most frequent neurodevelopmental disorders are autism spectrum disorder and attention deficit hyperactivity disorder. In recent decades, particularly since the Diagnostic and Statistical Manual of Mental Disorders permitted dual diagnosis, a considerable body of study has centered on comorbidity. The reported comorbidity rate between autism spectrum disorder and attention deficit hyperactivity disorder ranges from 14 to 78%. One of the most prevalent comorbid conditions in children with autism spectrum disorder is attention deficit/hyperactivity disorder. In clinical samples, a recent assessment of 35 research examining the combination of autism spectrum disorder and attention-deficit/hyperactivity disorder showed between 37 and 85 percent. 15 to 25% of children with attention deficit hyperactivity disorder show autism spectrum disorder features.

Executive function refers to higher-order cognitive processes that lead complicated, goal-directed behaviors in an environment that is dynamic and constantly changing. This term is inclusive of metacognitive domains such as reaction inhibition, working memory, cognitive flexibility planning, and fluency. These activities have been connected, specifically to the prefrontal cortex, suggesting that the brain regions crucial for executive functions are those damaged by autism spectrum disorders. In addition, crucial components of executive function are impaired in both illnesses and have been identified as possibly shared endophenotypes, highlighting the relevance of examining both conditions. In addition, the results of genetic, neuropsychological, and neuroimaging studies suggest potential pathophysiological links between autism spectrum disorder and attention deficit hyperactivity disorder, which affect key fronto-striatal and fronto-parietal circuits essential for the performance of executive functions and complex cognitive functions as an attention process.

Despite the influence that changes in executive functioning can have over the lifetime, most research on the relationship between autism spectrum disorder and attention deficit hyperactivity disorder symptoms has focused on childhood. Adults with executive impairments and concomitant autism spectrum condition and attention deficit hyperactivity disorder are the subject of few investigations. Different patterns of executive function abnormalities have been observed in children with autism spectrum disorder and attention deficit hyperactivity disorder, according to the research. When comparing the two groups of children with attention-deficit/hyperactivity disorder, reaction inhibition and sustained attention tasks are frequently reduced, but working memory, vigilance, and planning also demonstrate consistent and substantial abnormalities.

On the other hand, deficiencies in executive function are also observed in children with autism spectrum disorder, who frequently struggle with cognitive flexibility and planning. Numerous research have evaluated executive performance in individuals with attention deficit hyperactivity disorder and autism spectrum disorders, with contradictory results. Despite substantial data indicating the effects of executive functions on autistic spectrum disorder and attention deficit hyperactivity disorder, less studies have studied the co-occurrence of the two conditions.

Uncertainty surrounds the long-term functional consequences of children with autism spectrum disorders. Sixty to seventy-eight percent of adults with autism spectrum disorder have a poor or extremely poor adjustment to independent living, relationships, and employment chances. There is some evidence that individuals with autism spectrum disorders who have a higher IQ (above 70) have a better prognosis, although the label "high-functioning autism spectrum disorders" has not been used consistently and results have been inconsistent. Most high-functioning individuals with autism spectrum disorder have no close relationships, are underemployed, and are largely dependent on their families, according to longitudinal studies. Individuals' overall well-being, also referred to as quality of life, is a key component of the outcome. The goal of this research is to examine and provide recent data from the scientific literature about the efficiency and quality of life parameters in neurodevelopmental diseases.

2. Literature Review

Executive Functions and Neurodevelopmental Disorders

The cognitive processes responsible for coordinating problem-solving and goal-attainment are known as executive functions. Three executive processes are essential: inhibition, cognitive flexibility, and working memory. Working memory comprises the simultaneous processing, storage, and recall of information, whereas inhibition refers to the

ability to self-regulate and resist impulses. Cognitive flexibility is the capacity to adapt to various activities and to think creatively. Autism spectrum disorder is a neurodevelopmental illness marked by difficulties in social communication and interaction as well as confined and repetitive behavior patterns. Given its proposed role in contributing to specific impairments seen in neurodevelopmental disorders in the domains of theory of mind and social cognition, social impairment, restricted and repetitive patterns of behavior, and broader impacts on quality of life, executive function has been linked to developmental spectrum disorders. Many higher-order neuropsychological domains, including as goal-directed behavior, abstract reasoning, decision-making, and social regulation, are encompassed under executive function. It is well known that issues with executive functions play a crucial part in developmental spectrum disorder, which is characterized by faulty regional coordination and integration of prefrontal executive processes that integrate with various emotional and social circuits. Cortical volume and thickness abnormalities have been detected in both the frontal and other cortical brain areas. It has also been observed that abnormal functional network connection between prefrontal and other cortical and subcortical regions, which may be influenced by distinct executive subdomains, impairs executive function.

Quality of Life and Neurodevelopmental Disorders

The World Health Organization (WHO, 1995) defines quality of life as an individual's assessment of his or her place in life in the context of his or her culture and values, as well as regarding his or her objectives, aspirations, standards, and worries. In a recent meta-analysis conducted by Van Heijst and Geurts (2014), the developmental trajectory of QoL was examined, and it was determined that individuals with autism spectrum disorder suffer lower QoL compared to typically developing controls throughout their lifetime. Despite increased interest, however, relatively few research has examined the quality of life throughout the transition from youth to adulthood. This is notable, given the transition to adulthood is often challenging for individuals with autism spectrum disorders. Not only are young adults leaving their parents' homes but developing social interactions and becoming self-sufficient in daily life is becoming increasingly crucial. Regarding the evaluation of life quality, one can distinguish between objective and subjective quality of life. This is significant because it is crucial to understand whether and how pleasure at school or self-esteem predicts employability or job satisfaction in later life for this intelligent but underemployed population of autistic adults.

Quality of life, the subjective evaluation of an individual's well-being across several domains (physical, psychological, and social) and positive and negative characteristics, is therefore a key indicator of overall functioning (WHOQOL team, 1995). In the past decade, more research has been conducted on the quality of life of people with autism spectrum disorders. Individuals with the disorder have a lower quality of life than those without an autism spectrum disorder, and their quality of life remains low throughout their lifetime. Specifically, the social function appears problematic. People with autism spectrum disorder have inferior life quality than those with other psychiatric disorders. Urgent research is required to determine whether certain characteristics influence the quality of life in children with autism spectrum disorder, as treatments or interventions that target these factors may be effective. We anticipated, for instance, that children with autism spectrum disorder who had a higher IQ and better language development would have a higher quality of life than those who had more autistic symptoms and more deficiencies in executive functioning.

Performance Parameters and Neurodevelopmental Disorders

Cognitive Flexibility

Cognitive flexibility is the speed with which one can switch between several tasks. Children with autism spectrum disorder appear to have deficiencies in cognitive flexibility in daily life, which manifest as difficulties responding to the environment's shifting demands. Additionally, constrained and repeated daily activities has been associated with cognitive flexibility. However, similar deficiencies in cognitive flexibility in ordinary life are not consistently observed in study settings. There appears to be a discrepancy between cognitive flexibility in ordinary life and research settings. Additionally, it appears that children with autism spectrum condition benefit from structure, predictability, and consistency in their everyday activities. This is also observed in laboratory settings: children with autism spectrum disorder do not demonstrate impairments in switch tasks with known switches, but they do demonstrate deficits with unpredictable switches. Rather than cognitive flexibility, switching tasks with predictable switches may rely on stimulus-response learning. To evaluate cognitive flexibility, a switching task with unpredictable switches is necessary. Finally, cognitive flexibility is necessary in the majority of everyday scenarios involving the processing of complex data and social interaction. Faces should be complex and socially relevant in order to test cognitive flexibility in an empirically - based manner.

Working Memory

Working memory is the capacity to store, manipulate, and update data. Problems with visuospatial and linguistic domains during complicated activities appear to be associated with executive functions of daily living. However, this is not always the case. Inconsistent findings regarding age and tasks are frequently explained by differences. However, even in trials using a single working memory test, such as the maintenance and updating n-back task, the results remain ambiguous for children with autism spectrum condition. This may be a result of substantial individual variability within the autism spectrum disorder population, limited sample sizes, and a wide range of ages in the research.

Intersection between Executive Functions and Education

Another possible explanation for the contradictory findings regarding interpersonal functioning in developmental disorders is the overlap between the many characteristics of interpersonal functioning. Working memory and inhibitory control are interconnected and mutually influential. Working memory is most effective when only relevant information is processed, and irrelevant information is blocked from entering. In addition, children with working memory deficiencies may also exhibit deficits in inhibitory control, and vice versa. If this is the case, subgroups of children with developmental spectrum disorders with and without abnormalities in working memory and inhibitory control may also differ in terms of other cognitive and behavioral characteristics. Notably, deficiencies in working and inhibitory memory are prevalent in both attention-deficit hyperactivity disorder and developmental spectrum disorder. Regarding training in staff functions, it has been observed that therapeutic and educational interventions, such as cognitive behavioral therapy and social skills training, are especially beneficial for staff, significantly enhancing the quality of life for individuals with neurodevelopmental disorders.

3. Methodology

Search technique

We searched the PsycINFO, PubMed, and SCOPUS databases for relevant articles (2022). In addition, we employed the following combination of terms: Attention Deficit Hyperactivity Disorder, Autism Spectrum Disorder, Executive Functions, and Quality of Life. We utilized broad search criteria so as not to overlook pertinent material.

Inclusion Standards

To be included in this systematic review, the publications had to be written in English and published between 2010 and 2022 in peer-reviewed journals. The preliminary inclusion of titles and abstracts was determined based on a title search and subsequent abstract assessment. The search was improved based on the inclusion criteria in chosen articles that presented findings pertinent to executive functions and life quality.

4. Results

The findings of this analysis have implications for educational practice, alerting practitioners to the necessity to examine deficiencies in executive functioning in children with developmental spectrum disorder and attention deficit hyperactivity disorder comorbidity. It is essential because children with distinct coping styles will likely respond differently to treatments. It has been established that education enhances intellectual and social abilities. As executive dysfunction is the primary limitation of attention-deficit hyperactivity disorder, a number of research with promising outcomes have been presented to examine the impact of cognitive skills training. Studies focusing on the impact of cognitive skills training in developmental spectrum disorders are uncommon. By applying a cognitive-behavioral intervention in schools with an emphasis on flexibility and planning, for instance, parents' and teachers' assessments of change and planning/organization have been normalized. In a similar vein, the implementation of a school-based program to build teenage social skills has shown encouraging gains in children with high-functioning autism's emotional regulation, working memory, planning, and monitoring. Children and adolescents with developmental spectrum disorder and attention-deficit hyperactivity disorder co-occurring have demonstrated improvement in attention, impulsive symptoms, and academic success following executive function training. Further research is required to give a more comprehensive understanding of the underlying profile of efficacy associated with both disorders, to build a more tailored treatment strategy.

In a survey of one hundred families with a young adult relative who was diagnosed with autism as a kid, nearly 91 percent of respondents assessed the quality of life of their relative with autism as ideal. However, most participants required assistance in their professional and leisure endeavors. While research such as these illustrate the necessity of examining objective markers of quality of life in autistic persons, just asking objective questions will fail to achieve the goal of understanding how the individual evaluates perceived need. Renty and Roeyers (2006) made the crucial observation that the relationship between quality of life and the perception of the availability of support is stronger than the relationship between quality of life and the effects of actual supportive behaviors in people with high-functioning developmental disorder. In addition, this study indicated that the self-reported quality of life of adolescents with high-functioning developmental disability is poorer than the population average. Recent research by Barneveld et al. (2014) measured both objective and subjective quality of life in high-functioning developmental disorder and found that young adults with this disorder were

less satisfied with their work or education, partner relationships, and prospects in relationships compared to adults with other disorders, such as attention-deficit hyperactivity disorder, disruptive behavior disorder, or affective disorders. In comparison to individuals with other early psychiatric and neurodevelopmental problems, it was determined that young adults with high-functioning developmental disorders had a higher risk of low quality of life.

Numerous studies have attempted to identify predictors of poor outcomes or quality of life in individuals with autism spectrum disorder. In a recent study, Magiati et al. (2013) found that IQ and language skills are among the greatest predictors of quality of life in individuals with autism spectrum disorder: Specifically, a correlation was observed between childhood IQ and enhanced adaptive functioning and social outcome in adulthood. Others have argued that social connection with peers is a more reliable predictor of adaptive functioning in individuals with autism spectrum disorder than IQ. It is well known that children with autism spectrum disorder are less accepted by their peers and have fewer mutual friends. This may be due to difficulty in regulating behavior and emotions, which may be the consequence of insufficient self-regulation skills. Positive adjustment and adaptation need high levels of self-control. Self-regulation refers to the cognitive and behavioral processes by which an individual maintains emotional, motivational, and cognitive arousal levels that promote positive adjustment and adjustment, as evidenced by positive social relationships, productivity, achievement, and a positive self-concept. One-year-olds with a diagnosis of autism spectrum disorder have reported problems with self-regulation. Despite not being included in the diagnostic criteria, regulatory dysfunctions are regularly detected in individuals with autism spectrum disorders. Both executive function and emotion processing are crucial components of the effortful regulation of attention and behavior. In youngsters with a severe developmental handicap, Jahromi et al. (2013) found that assertiveness predicted emotional involvement and emotion regulation predicted prosocial peer engagement. In addition, neurobiological studies reveal that dysfunctions in particular social-emotional processing-related brain circuits are associated with self-regulation in autism spectrum disease. Given the awareness that self-efficacy and emotion processing are key concepts of self-regulation for altering adaptive behavior in children with autism spectrum disorder, and therefore their future quality of life, it is possible to modify these children's adaptive behavior. Executive functioning is comprised of a multitude of component processes necessary for the control and execution of complex behaviors.

Included are planning, inhibition, working memory, and cognitive flexibility. In autism spectrum disorder, a growing corpus of research focuses on executive functioning, however the results are inconsistent. The association between quality of life and effectiveness has only been explored in children with autism spectrum disorder, despite the constant accumulation of research on efficacy in autism spectrum disorder. De Vries and Geurts (2015) discovered that the quality of life of children with autism spectrum disorder was poorer than that of control children. This worse quality of life was linked to deficiencies in executive function. Given that executive functioning deficiencies in normally developing children can predict long-term accomplishment, it is crucial to determine whether these same associations exist in young adulthood. It has been discovered that people with functional impairments whose executive functioning is superior experience a higher quality of life. In addition to the dimension of effectiveness, another key aspect of self-regulation is the awareness of emotions and the ability to govern them. Emotion regulation is the automatic or purposeful change of a person's emotional state that facilitates adaptive or goal-directed behavior. According to reports, people with autism spectrum illness are at a significant risk for alexithymia, which translates to "lack of language for emotions." The word alexithymia refers to a diminished awareness of emotions,

manifested by a diminished capacity to perceive, feel, verbally describe, and reflect on one's emotions. In research by Berthoz and Hill (2005), people with autism spectrum disorder demonstrated a cognitive variant of alexithymia, indicating that conscious knowledge of emotional arousal looked intact, but the strength of emotions preceding cognitive cognitions was lower than in controls. It is hypothesized that the inability of many people with high-functioning developmental disorders to apply adaptive emotion processing mechanisms stems from abnormal emotional reactivity and a lack of emotional insight required to modulate or control emotion.

5. Discussion and Conclusion

In conclusion, the results show that it is difficult to discern a probable performance profile difference between the comorbidity group and those with attention deficit hyperactivity disorder or autistic spectrum disorder. It is a research question for the future. Although it is hard to get significant evidence for executive function profiles in the autism spectrum disorder and attention deficit hyperactivity disorder comorbidity group, research support the notion that children and adolescents with autism spectrum disorder and attention deficit hyperactivity disorder frequently share clinical symptoms. However, it remains uncertain if the combined symptoms of the two illnesses reflect a separate phenotypic or just overlapped phenotypes. In clinical practice, if the differential diagnosis is a subject of controversy, this may be consistent. According to the present review, executive functioning deficiencies can predict subjective quality of life. To improve the quality of life for high-functioning persons with neurodevelopmental problems, it is necessary to implement early, customized therapy interventions with the ultimate objective of training in executive functions. Disorders. In children with attention deficit and a developmental spectrum disorder, neurofeedback has been found to enhance executive control. Virtual reality training looks to be a viable new approach for enhancing cognitive flexibility among those with autism spectrum disorder. Emotion regulation training, such as cognitive behavioral therapy, is also good for contemplating and discussing emotions. Future therapeutic approaches should prioritize effectiveness and emotion processing in order to enhance the quality of life for those with autism spectrum disorder. This may aid in the development of specialized training in coping and emotion management for early adolescents with autism and high cognitive functioning.

The field of Neurosciences and specifically the utilization of what is known about the executive functions of the brain are inextricably linked to the quality of life of individuals with neurodevelopmental disorders who may benefit from innovative multisensory educational and therapeutic interventions based on the theory and research findings presented. The aforementioned questions merit equal attention and investigation. They demand the interest and consideration of the educational community. Information programs, specialized seminars for teachers and parents in the context of lifelong learning, information days and open dialogue with neuroscience experts, the enshrining of the neuroscience course in education as a mandatory and necessary academic course for prospective teachers, as well as the participation of the teachers themselves in the research process, are some of the proposed answers to the aforementioned questions. In conclusion, the specialization and growth of neurosciences in pedagogical sectors, together with the right information and direction of instructors, may be a crucial element in student achievement and outstanding classroom improvement. According to the demands of the moment and each new generation that has the desire and ability to contribute to bettering the world, the school class must constantly develop, alter, and adapt.

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