Assessment of Intellectual Functioning among Children with Neurodevelopmental Disorders: Challenges and Implications Beyond the Clinical Practice

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Abstract: Early and precise identification of neurodevelopmental disorders together with provision of adequate and timely interventions remain increasingly important tasks for multidisciplinary clinical teams. A central component in this process of comprehensive clinical evaluation is the assessment of children's intellectual functioning. Intelligence test results represent a central component in the decision making process of determining a child's future in terms of: qualification for special education, access to social welfare support, placement in therapeutic programs, etc. Clinical results yielded through the application of standardized intelligence assessment instruments (WISC, K-ABC, RPM), and especially the overall quantitative measure of cognitive ability (IQ) have become a central, and sometimes the only measure taken into consideration when determining a child's level of functioning. Together with some distinct benefits, this practice places many children at risk of being underestimated and calls for revision and modification of standard assessment procedures. In line with these considerations, authors raise for discussion traditional approaches to diagnostics of intellectual functioning, highlighting some challenges, emerging from the constitutive particularities in the cognitive functioning of children with neurodevelopmental disorders. An attempt for identifying areas for further improvement alongside with research-informed recommendations for a contemporary, individualized and sensitive to the specifications of children with neurodevelopmental disorders assessment practice are outlined at the end of this paper. According to the authors' opinion, exploration of the topic provides an important opportunity to advance the understanding of clinicians, primary healthcare professionals, educators and other professionals involved in supporting children with developmental deficits.

Keywords: Neurodevelopmental disorders, cognitive functioning, intelligence testing, Wechsler intelligence scales for children (WISC), profile analysis.

INTRODUCTION

Intellectual assessment is an indispensable part of the overall clinical evaluation of children with neurodevelopmental disorders. Intelligence test results are often used as a central measure in decision making processes determining a child's future in terms of: qualification for special education, therapeutic programs and access to social welfare support. This practice often raises significant challenges when applied to the very special group of children with neurodevelopmental disorders. It is a generally established fact that intellectual functioning is more challenging to assess in individuals with neurodevelopmental disorders than in those with typical development. There are no specialized instruments designed to address this special population, while at the same time, the application of standard instruments (WISC, K-ABC) may render rather dubious results. Standardized methods for intellectual assessment have been in the focus of research for the past decades with their advantages being proven throughout the years. Despite the high reliability and validity, intelligence tests such as the Wechsler Intelligence Scales for Children (WISC) or the Kaufman Assessment Battery for Children (K-ABC) pose a number of challenges when applied to a special population such as children with developmental deficits. Such arguments validate the necessity of discussing and even revisiting existing intellectual assessment practices in order to better address the comprehensive needs of children with neurodevelopmental disorders.

According to the latest edition of the Diagnostic and Statistical Manual of Mental Disorders, neurodevelopmental disorders (NDDs) constitute a group of lifetime conditions with onset in the period of development [1]. The range of developmental deficits may vary significantly "from very specific limitations of learning or control of executive functions to global impairments of social skills or intelligence" [1]. Another important aspect is the high degree of comorbidity within the group of neurodevelopmental disorders [1].

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In terms of intelligence and cognitive abilities, specific deficits and/or deviance in functioning could be observed in most children with NDD, ranging from global delay (as in children with Intellectual disability) to specific difficulties in visual-motor coordination, attention, language comprehension, etc.

Unusual degree of variance in cognitive abilities of children with NDDs has been largely reported in numerous research papers [2-4]. Typically, high degree of scatter as measured with the Wechsler Scales (different revisions) together with significant discrepancies between verbal and nonverbal performance occur at much higher rate among children with learning disorders and autistic children as compared to typically developing children [3]. A large and growing body of literature has investigated cognitive functioning in autism with even increased interest after the inauguration of a specifier for cognitive abilities in DSM-5 [1]. The level and nature of autistic intelligence has been a major area of interest for many authors [3,5-9]. Apart from the typical for the disorder abnormalities in social-emotional development and communication, individuals on the autistic spectrum are characterized by atypical cognitive functioning, marked by both deficits and "islets" of ability [8]. Such discrepancies are often observed in clinical practice and relate to the presence of inexplicable cognitive strengths in the context of generally low developmental level. Even more disadvantaged and challenging to assess are autistic children that are considered as non-verbal or minimally verbal. In most cases, limited or no expressive language capacity is an exclusion criteria for this children that leads to their subsequent labeling as "low functioning" or even "untestable". Therefore, as Eagle suggests, when measuring intelligence in autism the main challenge is more of "accessing" intellectual abilities than assessing them [9].

Apart from autism, other neurodevelopmental disorders spark considerable attention in terms of cognitive abilities. The well-renown discrepancy between low academic achievement and normal or even high intellectual capacity in children with learning disabilities has been widely reported [4,10,11] and even considered in the process of differential diagnostics. Persistent in time impairments in cognition, mainly in terms of attention span, executive functioning and short-term memory, in children with ADHD have been also documented [12]. All these particularities call for special considerations when conducting assessment with traditional intelligence tests.

TRADITIONAL ASSESSMENT PRACTICES

Best-practice clinical routines require adherence to highly structured, evidence-based procedures through the utilization of formal standardized measures of assessment. There are a large number of well-researched instruments available for assessment of intelligence in childhood and adolescence. Some of the most prominent and most widely used include: Wechsler Intelligence Scales for Children (WISC) and Wechsler Preschool and Primary Scale of Intelligence (WPPSI), Stanford-Binet Intelligence Scales (SBIS) and Kaufman Assessment Battery for Children (K-ABC). Though relying on principally different theoretical and factor models, all of these instruments yield a quantified measure of global intellectual functioning or an intelligence quotient (IQ) which is considered the most widely used indicator of the average mental capability of a given child. Individual's IQ score is obtained through the accumulation of results on various structured tasks that operationalize complex cognitive abilities, processes and problem-solving skills such as: working memory, attention span, visual perception, visual-motor coordination, sequential reasoning, reception of language, verbal fluency, mathematical skills etc. Therefore, a principle distinction between intelligence and IQ should be made clear in light of preventing generalization of IQ measures and misinterpretation of test results.

IQ is an average estimate of the overall intellectual capacity as measured through an individual's performance on a standardized intelligence test. The latter point being a valid argument to make the conclusion that although a valid and valuable construct, IQ is an approximation and not a credible reflection of actual intellectual capacity. Nevertheless, when applied with precision and interpreted contextually by an experienced clinician, IQ is a measure of indispensable importance, especially for the purposes of differential diagnosis of intellectual disability. IQ scores are also applied within the traditional approach for identifying children with learning disabilities known as "intelligence-achievement discrepancy model" [11].

Although IQ is traditionally pursued as the final output in intellectual assessment, many clinicians and theoreticians assert that implications, broader than yielding a single quantitative measure of global cognitive functioning, should be pursued in the process of assessment. Many of the comprehensive intelligence assessment batteries (WISC, SBIT, K-ABC) provide a framework for exploring important qualitative aspects of

cognitive functioning that could subsequently inform therapeutic and educational intervention planning [13]. Standardized tests allow for an experienced professional to utilize test results for obtaining valuable information about the cognitive strengths and weakness of the child across various domains, which is especially important when applied to children with neurodevelopmental disorders since it could inform individualized educational supports [14,15].

CHALLENGES

It will not be exaggerated to say that hardly any topic in the field of psychology has sparked more controversial debates than the nature and structure of intelligence. In line with these debates, the question of "What do intelligence tests really measure?" is still an object of controversy. The issue has grown in importance in light of the increasing concerns of practitioners, educators and parents of children with atypical development, that gravitate around the question of how accurate are existing standardized tests in reflecting objectively the actual potential of the developmentally challenged child. It is a well-recognized reality that despite their long history and documented clinical success, intelligence tests pose a number of challenges in their use and further application of results when applied to special populations such as children with NDDs.

Debates over the utilization of IQ scores as a determinant variable in decision making across various domains of a child's future have been going on for many years [16,17]. Serving as the primary measure of ability with its cut-off scores being utilized for categorizing individuals, served the purpose of classification to some extent, but hardly provides any information about the underlying cognitive processes, level of adaptive functioning, precise strengths and weaknesses of the child.

When discussing challenges and limitations in intelligence testing, we should be aware of the fact that most standardized measures of assessment (such as the Wechsler Scales) are influenced by Spearman's concept of "general intelligence" (factor "g"), which implies that a single broad mental capacity accounts for the performance on various cognitive tasks [16]. While this may easily be an explanation model in the case of a typically developing child, where a homogeneous profile of intelligence is observed with minimum variations in performance across the various cognitive tasks, such "harmony" is a rare finding in children with NDDs. (Intellectual disability marks an exception since low functioning is constitutive for the disorder and affects all domains of intelligence [1]).

In line with the above mentioned, numerous researchers point out another major challenge in using traditional measures of assessment – the fact that the majority of tests are standardized on typically developing populations and thus lack sensitivity to the specifications of atypically developing children [16,17]. There is no well-researched test designed specifically for children with developmental deficits, although clinical samples are addressed in the process of standardization of most of the existing batteries. In other words or as Kauffman posits "Evaluation, and subsequent identification of disability, involves a process of comparison." – and comparison with the right group of individuals [18].

Questions have been raised also in regards to implication of test results in predicting future developmental changes [14,16]. As already mentioned, IQ test results are largely used as a milestone in decision making for a child's future. Yet IQ test performance does not yield any information about adaptive functioning or prognostic developmental trajectory of the individual child. In our clinical practice we often witness cases of children with the same full scale IQ who differ dramatically in terms of independence, maturational level and abilities for self-reflection. What is the child's susceptibility to intervention is also a question left unanswered by standardized intelligence tests.

Another shortcoming of traditional assessment batteries relates to the specifications of cognitive functioning in autism and more precisely to those cases where savant skills are present in children with ASD – skills that cannot be reflected by standardized intellectual assessment measures due to the lack of sensitivity to these "islets of ability" found in high-functioning autism [16].

On a process level, there are additional challenges deriving from some common difficulties that children with NDDs often exhibit, such as: inattentiveness, resistance to change, psychomotor restlessness, fixation on details, difficulties in understanding and following verbal instructions, etc. Most standard instruments presuppose long and tedious assessment sessions that could be excessively stressful and even overwhelming for children with developmental deficits. This may often "contaminate" results since failure to

finish the probes can be attributed to factors other than lack of knowledge and ability. In addition to this, the overly structured administrative procedure of the majority of tests could be very frustrating to some children with NDDs for numerous reasons. First of all, provision of feedback is limited to single, neutral phrases, such as "*ok*" or "*continue*" (as in the Wechsler Scales), while at the same time and in most cases children with developmental difficulties require much more warmth, encouragement and direct support in order to reveal their full potential. Lack of any possibility for modifying instructions together with time pressure and mechanistic change of tasks and stimuli could diminish performance and yield lower, unrealistic results in significant incidence of cases. In line with these practical observations, we should highlight that standardized measures of assessment adhere to a highly structured set of procedures, which in turn often limit the flexibility of the examiner as well as all opportunities for a more individualized approach to evaluation.

CONTEMPORARY TRENDS AND GOOD-PRACTICE RESOMMENDATIONS FOR INTELLECTUAL ASSESSMENT

In line with the challenges mentioned above, there has been a considerable advancement in the fields of neuropsychology and cognition as well as a growing body of research on intellectual functioning in neurodevelopmental disorders. These processes influence directly our understanding of the disorders and could further improve best-practice assessment routines. A positive "trend" in this regard is the marked shift in perspectives from IQ-oriented assessment towards a more cognitive-processing oriented perspective [15].

One of the milestones towards a more objective and comprehensive interpretation of intelligence test results comes with the practice of qualitative analysis, implying not only conclusions based on the final quantitative measures (i.e. IQ and subtest scores), but an individualized exploration of cognitive processes underlying these results, as well as rendering account of the contextual and environmental factors influencing the performance of a given child. One of the "pioneers" of qualitative assessment procedures is Prof. Alan Kaufman, who coined the term "intelligent testing" and asserted that test results should be subjected to both quantitative and qualitative analysis by an experienced and well-trained professional [13]. Kaufman's model applies sound scientific principles to the analysis of test results in order to increase their ecological validity and reduce misinterpretation of a single quantitative measure such as the IQ.

Although subjected to a large amount of criticism, profile analysis and profile comparison remain widely spread clinical and research procedures that yield some valuable data in regards to discriminating between the different groups of neurodevelopmental disorders. Since the Wechsler Intelligence Scale for Children (in its different revisions) is the most popular test for evaluation of school-aged children, there is a considerable amount of literature on intergroup comparisons using the WISC although the initially supposed diagnostic validity of the instrument has been rejected [2]. Previous studies have reported a high degree of variability in the profile scatter of children with ASD [3,8] Typically low results on certain subtests (e.g. WISC-R "Comprehension") have been also documented by researchers in children with ASD [3, 12]. VIQ-PIQ discrepancy is another important index that deserves attention since it could indicate a potential learning disorder [10] although such differences are not necessarily observant in all children with LD and may have different causality.

Another sensitive issue that predestines in many ways the evaluation outcomes relates to the careful choice of instruments when assessing individuals with NDDs. There is an existing variety of standardized measures of intelligence, which yield different results when applied to developmentally challenged children. An experienced clinician must be well-acquainted with the instruments available, as well as with existing research data on their application among special populations in order to make an informed selection of the most-suitable instrument prior to each assessment. A good example in this regard is the reported preference of some clinicians and researchers to use Raven's Progressive Matrices (RPM) with individuals expected to be on the autistic spectrum, since RPM is entirely non-verbal and yields relatively higher results than WISC, especially among low-functioning individuals [7,8]. Nevertheless, these findings could be easily criticized [19], since RPM is not a real battery of subtests but a series of unitary tasks for visual problem solving and sequencing, which (in our perspective) is one of the typical cognitive strengths of autistic children. Even so, the problem of determining the level of cognitive functioning of children with ASD remains a challenge, especially in non-verbal and minimally verbal children. In the course of every-day practice, the

team of clinical psychologists at the Clinic of Child Psychiatry to the University Hospital Alexandrovska has met this challenge through the utilization of one unpopular but psychometrically sound instrument, namely the Borelli-Oléron Performance Scale (Echelle de performance Borelli-Oléron) [20]. The scale comprises of seven performance tasks and allows the estimation of a global level of functioning, together with the elaboration of an individual profile of performance.

Another aspect of evaluating children with NDDs that requires advancement, relates to ensuring more flexibility in intelligence assessment applied both to test administration and interpretation of results. Nevertheless, flexibility is a "double-edged sword" when applied to clinical assessment and therefore it should be a privilege only to highly experienced professionals since there is a risk of contamination or misinterpretation of results. Although intelligence tests are becoming increasingly comprehensive and reliable, clinical judgement should remain the most important component of the decision making process.

As stated above, intelligence test results and IQ in particular should not be taken as a single measure of ability. Additional aspects of functioning are due to receive substantial clinical attention. Level of adaptive functioning, socio-emotional understanding and available contextual support should all be taken into consideration in critical decision making for all children with NDDs.

Appropriate management of interactions with the child during the assessment must also be a focus of attention to the clinician. Surmounting rejection and negativism as well as capturing and maintaining the attention of the child require not only knowledge and experience, but also warmth, patience ingenuity and creativity in order to "trick" the child into accepting and completing a given task. In line with the ever increasing advancement of technologies, some authors even suggest utilization of a technological components (i.e. using a tablet or multimedia) in order to facilitate and further engage children in the assessment process [13].

There have been also some more radical opinions that call for complete "scientific reconstruction" of existing theoretical and practical models of assessment in order to make more objective comparisons within the group of developmentally challenged individuals and thus denounce any form of discriminative practice [18].

CONCLUSION

From a clinical perspective, the primary goal of early assessment is to rule in/rule out a diagnosis as early as possible in order to inform subsequent important decisions for the child's future. Therefore, evaluation of intellectual functioning plays an important role in this regard since IQ is "a powerful indicator of the integrity of the individual child's problem-solving system" [17]. Clinical utilization of IQ tests should not be underestimated since they still present the best-practice approach for determining the overall cognitive potential of a given child, as well as differentiating intellectual disability from learning disabilities and language disorders [17]. Nevertheless, additional measures of functioning should be taken into consideration with increased importance, together with a more extensive adoption of individualized, child-centered approach to assessment and intervention planning. Considering the above shared trends and opinions, we can draw the conclusion that intellectual assessment must be executed with high precision and a pinch of creativity, bearing in mind that no test could capture in completion the multifaceted nature of intelligence in any individual, especially in those falling within a special population such as neurodevelopmental disorders.

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