

## CURRENT PERSPECTIVES

### Specific learning disorders – the role of the pediatrician in a multidisciplinary approach

#### Perturbações específicas de aprendizagem – o papel do pediatra numa abordagem multidisciplinar

Inês Gandra<sup>1</sup>, Catarina Freitas<sup>1</sup>, Carolina Castro<sup>1</sup>, Inês Maio<sup>1</sup>, Cláudia Gonçalves<sup>1</sup>



#### ABSTRACT

The main specific learning disorders are addressed, with regard to their definition, screening, diagnosis and general therapeutic guidance strategies. Particular attention is given to the role of the Pediatrician in early identification of risk factors and clinical manifestations, timely referencing for evaluation by appropriate subspecialists - contributing to a timely diagnosis and early intervention - and overall coordination of the multidisciplinary team.

**Keywords:** dyscalculia; dysgraphia; dyslexia; impairment in mathematics; impairment in reading; impairment in written expression; specific learning disorder

#### RESUMO

São abordadas as principais perturbações específicas de aprendizagem, no que respeita à sua definição, rastreio, diagnóstico e estratégias gerais de orientação terapêutica. É dada particular atenção ao papel do pediatra na identificação precoce de fatores de risco e manifestações clínicas, referência atempada para avaliação por subespecialistas apropriados - contribuindo para o diagnóstico e intervenção precoces - e na coordenação global da equipa multidisciplinar.

**Palavras chave:** défice da leitura; défice na expressão escrita; défice na matemática; discalculia; disgrafia; dislexia; perturbação específica da aprendizagem

1. Department of Pediatrics, Unidade Local de Saúde de Matosinhos. 4454-509 Matosinhos, Portugal.  
inesgandra6@gmail.com; ana\_cat\_f@hotmail.com; carolina.coelhodecastro@gmail.com; inesmaiogoncalves@gmail.com; claudiaipgoncalves@hotmail.com

## INTRODUCTION

Specific learning disorders (SLDs) are conditions that impair the way we learn and process information. They affect several domains of learning, such as reading (SLDs with impairment in reading), writing (SLDs with impairment in written expression) and arithmetic (SLDs with impairment in mathematics). Earlier manifestations are usually seen during childhood, but can persist into adult life, with potentially serious impact in crucial life skills.

The global prevalence of these three learning disorder categories is currently estimated at 5%-15% in school-age children, and they appear to be more common in males than females.<sup>(1)</sup>

## MAIN THEME

### 1. DIAGNOSTIC CRITERIA

The diagnosis of a specific learning disorder can be very complex and requires extensive knowledge on several aspects of the patient's history and daily life. The clinician will need to evaluate not only the child's medical, developmental and familial history, but also try to integrate that information with data obtained from school reports and psychoeducational assessments. According to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), there are four diagnostic criteria that need to be met in order to make the formal diagnosis of a learning disorder.<sup>(1)</sup> Those criteria are:

- A. Learning difficulties that persist for at least 6 months despite the provision of adequate support and targeted interventions;
- B. Academic performance below what is expected for age (either evaluated subjectively or by standardized tests, when available and applicable);
- C. Learning difficulties that begin during early school years (although they may not manifest until a later age, when academic demands surpass the individual's capabilities);
- D. Difficulties that are not better explained by other internal or external factors (such as intellectual disabilities, vision or hearing impairment, neurological disorders, economic or environmental disadvantages, absenteeism, etc.).

An official diagnosis of a specific learning disorder is usually made by educators and psychologists, through the review of the criteria listed above and the application of specific psychometric evaluations.

### 2. ROLES OF THE PEDIATRICIAN AND PRIMARY CARE PROVIDER

Despite not having an active role in the tasks directly related with the establishment of an official SLD diagnosis, the pediatrician and the primary care provider play other roles of utmost importance in

the management of children with SLDs, as the providers with most intimate and detailed knowledge on the child's development and familial context.<sup>(2)</sup>

Firstly, there are several risk factors that have been shown to be associated with a higher probability of developing SLDs, that physicians can keep watch for. They are, among others:<sup>(3)</sup>

- **Family history:** Children with familial history of learning disorders (particularly when affecting reading and writing) appear to be at a higher risk also having impactful learning difficulties;
- **Medical history:** Pre or postnatal exposure to known neurotoxicants (such as air pollution, nicotine, or lead), premature birth, recurrent otitis media, genetic syndromes;
- **Socioeconomic conditions and cultural background:** Economical disadvantages, unsafe home environment and adverse childhood experiences can negatively affect child development.

Secondly, symptoms of these disorders may already be present during preschool years, before the age in which an official diagnosis can be made (**table 1**).<sup>(1)</sup> Routine check-ups are often the place where caretakers first mention concerns regarding some of these symptoms, or can serve as a time to implement informal testing to assess trouble areas in need of further investigation.<sup>(2,4)</sup> Specific red flags and screening measures are further explored later in this text.

Another important aspect to note is that different types of learning disorders are usually comorbid with one another, and with other neurodevelopmental and mental disorders (such as autism spectrum disorder, attention deficit hyperactivity disorder, depression and anxiety). The primary provider has an important role in the identification of potential comorbidities and in their differential diagnosis and adequate treatment.<sup>(3)</sup>

Lastly, the pediatrician has an active role in coordinating the multidisciplinary approach to patient evaluation and care. The broadness of clinical manifestations and diagnostic criteria and the interplay of genetic and environmental factors add layers of complexity to patient management. As the first point of contact with healthcare services, the pediatrician (and primary care provider) has the responsibility of articulating with the other members of the care team, such as psychiatrists, psychologists, physical, occupational and speech therapists, and educators, facilitating communication between the family and these professionals and ensuring adequate care and adherence to treatment measures.<sup>(1,4)</sup> Furthermore, pediatricians and primary care providers can contribute with education and support for the family and coordination of care with the educational system, assuring a holistic and multifaceted approach to patient care.<sup>(2)</sup>

### 3. SHORT AND LONG TERM PROGNOSIS

**Table 1.** Manifestations of learning disorders in preschool-age children (DSM-V)

Lack of interest in playing games with language sounds  
Difficulty learning nursery rhymes  
Using baby talk  
Mispronouncing words  
Trouble learning letters, numbers or days of the week  
Difficulty recognizing own name in written form or writing it  
Behavioral problems

Despite the best interventions, children don't outgrow the diagnosis of an SLD - changes in manifestation of symptoms occur with age, so that an individual may have a persistent or shifting array of learning difficulties across the lifespan.<sup>(1)</sup>

Regarding the impairments directly related to the specific SLD, it has been shown that early identification of the specific learning disability and treatment that begins by the third grade at the latest leads to the best outcomes. Later identification has been shown to lead to poorer prognosis, such as an ongoing failure to achieve grade-level standards and subject fluency.<sup>(5)</sup>

On another note, SLDs have indirect consequences in all measures of daily life. Children with SLD, in comparison to their peers without it, experience more emotional distress and have increased risk for negative mental health outcomes (including suicidality). Moreover, these children end up having higher rates of school and college dropout, unemployment and underemployment, and lower incomes.<sup>(1,6)</sup>

All in all, it is easy to understand that learning disorders can have repercussions in all dimensions of a children's life, but early diagnosis and intervention appears effective in mitigating these effects. Therefore, the threshold for considering the potential diagnosis of a SLD should be low. All children suspected of having SLDs should be referenced for further evaluation, as early recognition and intervention can positively alter prognosis.

#### 4. INTERVENTION

Specific directed interventions to each SDL fall outside of the scope of this work, as those tasks mainly fall under the guise of educators and therapists, and will not be elaborated on. Nonetheless, the primary approach to addressing all learning disorders within the educational environment can usually be categorized into three main levels: accommodation, modification, and remediation. Accommodation involves enabling students to access the regular curriculum with the aid of supportive or assistive resources, without altering the educational content; modification signifies how the school may

adjust student's goals and offers services to mitigate the impact of the disability; and remediation entails the school delivering targeted interventions to reduce the severity of the student's disability. Given that the symptoms SLDs evolve in response to changing academic demands and cognitive development, managing these conditions is an ongoing and lifelong process that needs to adapt to the current level of impairment.<sup>(7)</sup>

#### 5. SPECIFIC LEARNING DISORDERS

##### 5.1. With impairment in reading

###### 5.1.1. Definition and prevalence

SLD with impairment in reading, according to the DSM-V, is a condition characterized by difficulties in one or more of these three academic domains - (1) word reading accuracy, (2) reading rate or fluency, and (3) reading understanding. The term dyslexia is now falling into disuse as it more so refers to problems related only to fluency and spelling.<sup>(1)</sup>

Genetic and neuroimaging studies have shown that this SLD has a hereditary component and is associated with brain differences that exist even before reading instruction begins.<sup>(8)</sup> Family studies of dyslexia suggest that it may be inherited to a significant extent, with heredity estimates reaching as high as 70%. Nonetheless, only a limited number of definitive genetic indicators have been discovered so far.<sup>(9)</sup> Recent epidemiologic, long-term data indicates a high prevalence of dyslexia, impacting 20% of the population; and in contrast with other learning disorders approached in this review, this SLD appears to have equal prevalence among boys and girls.<sup>(10)</sup>

###### 5.1.2. Warning signs

Research has shown that there are early red flags for SLD with impairment in reading that can be assessed as early as preschool age.<sup>(8)</sup> Firstly, the pediatrician should start by reviewing family history of SLDs, due to the strong hereditary component mentioned above. Secondly, it has been shown that children that had language delays

in both receptive and expressive realms during early childhood are at higher risk of developing further language and reading difficulties.

<sup>(11)</sup> Later, during kindergarten, some warning signs may be difficulties in letter identification, imitating sentences, rapidly naming objects, or low phonological awareness (shown by, for example, hardship identifying words that rhyme, words that start with the same sound/letter, or segmenting words).<sup>(12)</sup>

### 5.1.3. Evaluation and diagnosis

As with other SLDs, early diagnosis is key for adequate intervention and optimizing the patient's prognosis. Although an official diagnosis can only be made after reading instruction has begun, screening for risk of SLD with impairment in reading is possible to do at an earlier age through quick and inexpensive measures. The general pediatrician may implement some questions and tasks during routine checkups that serve to quickly evaluate overall language and literacy skills and act as an informal screening test. Examples of tests that can be easily implemented to assess preschool-age children are asking children to identify words that rhyme, draw and identify different letters and their sounds, and identify simple words by sight. In older children, they may be asked to read longer words or short pieces of text, interpret the text they have read, or write short sentences and paragraphs.<sup>(13)</sup>

Regarding comorbidities, impairment in reading has often been associated with poor mental health outcomes, as children with this SLD are more likely to suffer from generalized anxiety and present higher rates of depression. Speech disorders are also a frequent comorbidity (in about 50% of children affected) as both of these disorders have a basis in poor phonological awareness and other language deficits. Finally, other neurodevelopmental disorders, such as autism spectrum disorder (ASD) and attention deficit/hyperactivity disorder (ADHD), and behavioral disorders are also a frequent co-diagnosis.<sup>(8)</sup> Therefore, the paediatrician can further contribute to patient care by evaluating patients with SLD for the presence of these comorbidities, and also including this SLD in the differential diagnosis for concerns such as low self-esteem, depression, anxiety, or disruptive behaviors.

## 5.2. With impairment in written expression

### 5.2.1. Definition and prevalence

Writing is a multifaceted skill, crucial for the educational process and typically acquired during early childhood. SLD with impairment in writing is a broad term that encompasses any difficulty and individual may have in written communication, while the previously used term dysgraphia is now more so used to describe difficulties related to the motor act of writing.<sup>(7)</sup> Therefore, according to the DSM-V, this SLD may present with difficulties with (1) spelling accuracy, (2) grammar and punctuation accuracy, and/or (3) clarity or organization of written expression.<sup>(1)</sup> Its prevalence is estimated to range from 1.8% to 6.9%, with male predominance.<sup>(14)</sup>

### 5.2.2. Warning signs

The onset of this SLD can be in early childhood, before school enrolment, becoming more apparent as the child progresses to higher grades and work complexity increases.<sup>(7)</sup> Before entering school, these children may exhibit a variable range of developmental deficits, showing difficulty regarding coordination, and fine and gross motor skills - these difficulties may manifest through hardship getting dressed (buttons, shoelaces), using cutlery, using scissors.<sup>(14)</sup> More so, children may assume awkward body positions when writing, tire easily during or avoid writing and drawing tasks, have difficulty straying within margins or write letters that are poorly formed, reversed or inconsistently spaced.<sup>(7)</sup>

### 5.2.3. Evaluation and diagnosis

Though common in children, dysgraphia and disorders of written expression are often overlooked by the school and family as a character flaw rather than a genuine disorder, delaying diagnosis. However, an early diagnosis of this SLD is crucial as the limitations it imposes cannot be resolved without appropriate intervention and intervention is usually highly effective in rehabilitation.<sup>(7)</sup>

Notably, this SLD can occur in isolation but is often associated with other SLDs (particularly SLD with impairment in reading), ASD and ADHD, as mentioned for other SLDs. Moreover, characteristics of this SLD have a large overlap with those of developmental coordination disorder.<sup>(7)</sup> The general pediatrician, and/or the developmental-behavioral pediatrician, should have an important role in the differential diagnosis of these other conditions.

Similarly with SLD with impairment in reading, the pediatrician can apply simple screening tests and questions during routine evaluations to detect children at risk for this specific SLD. Questions to evaluate for SLD with impairment in written expression largely overlap with those used for SLD with impairment in reading (described above). An official diagnosis is typically made in the educational setting through multidisciplinary evaluation of several skills, such as writing speed, legibility of handwriting, consistency between spelling ability and verbal intelligence quotient, pencil grip, writing posture, etc. Formalized handwriting assessments may be applied.<sup>(7)</sup>

## 5.3 With impairment in mathematics

### 5.3.1. Definition and prevalence

Mathematics is a multifaceted field encompassing various sub-disciplines like arithmetic, algebra, geometry, and statistics. Reflecting this complexity, the DSM-V divides SLD with impairment on mathematics in four potentially affected domains: (1) number sense; (2) memorization of arithmetic facts; (3) accurate or fluent calculation; (3) accurate math reasoning. The term dyscalculia, previously used as synonymous with this SLD, is now used more so to refer to difficulties regarding only the first 3 domains mentioned above.<sup>(1)</sup> Epidemiological studies show that a substantial proportion

of school-age children have difficulties learning mathematics, a problem that affects between 5% and 7% of the population.<sup>(15)</sup>

### 5.3.2. Warning signs

Regarding red flags, earliest manifestations are represented in preschool-age children through difficulties in performing tasks that require comparison of quantities and numbers, rapidly recognizing small quantities, mastering counting, and identifying Arabic numbers. These skills have been found to be reliable predictions of later calculating ability. As schooling progresses, children with this disorder may have hardship learning single digit addition and/or multiplication, and later solving more complex equations and problems with different steps and types of operations.<sup>(16)</sup> The hereditary factor is also recognized as an important risk factor, similarly to other SLDs, though more thorough investigation is needed in this field.

### 5.3.3. Evaluation and diagnosis

As for other SLDs, impairment in mathematics can have long lasting repercussions in child development that have been shown to translate into adult life through impact in personality development, schooling and occupational training.<sup>(16)</sup>

In terms of comorbid conditions, many children and adolescents with this disorder have associated cognitive dysfunction (for example, impairment of visuospatial skills or working memory), and anywhere from 20 to 60% are estimated to have other disorders, such as ADHD or SLD with impairment in reading.<sup>(16)</sup>

Concerning screening measures that the general pediatrician may simply evaluate preschool-age children by asking them to count two sets of objects and asking which of them is larger/smaller, asking to identify what is heavy/light, long/short, near/far, asking to count to a certain number, or to identify some numbers. Later on, pediatricians can ask school age children to solve simple addition or subtraction problems, either using objects or pen and paper.<sup>(4)</sup>

Formal diagnosis of this disorder is a complex process, reflecting the complexity of its pathogenesis - there are multiple mathematical domains, each requiring different numerical, conceptual, and procedural knowledge. The knowledge of which domain or group of domains is most affected may help guide more effective and tuned interventions.<sup>(15,16)</sup>

## CONCLUSION

A multidimensional approach to specific learning disorders, which considers multiple levels and factors, offers substantial advantages over a categorical approach. To address the diagnostic and therapeutic challenge, a consortia of multidisciplinary professionals can play a crucial role, facilitating the exchange of expertise and ensuring intervention in all dimensions of child development.

The pediatrician and primary care provider are ideally positioned

to recognize risk factors, identify early warning signs and investigate comorbid conditions. Moreover, these providers can easily communicate with families and educators to further investigate existing clinical suspicions, and coordinate the actions of the multidisciplinary team members. Above all, clinicians should note that the long term impact of a late diagnosis can be sizable, therefore the threshold to refer to further evaluation should be low, as the impact of a missed diagnosis is typically far greater than that of an erroneous one.

## AUTHORSHIP

Inês Gandra - Investigation; Methodology; Writing – original draft; Writing – review & editing

Catarina Freitas – Investigation; Methodology; Writing – original draft; Writing – review & editing

Carolina Castro – Investigation; Methodology; Writing – review & editing

Inês Maio – Conceptualization; Writing – review & editing

Cláudia Gonçalves - Conceptualization, Writing – review & editing

## REFERENCES

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. American Psychiatric Association; 2013.
2. Bravender T. School performance: the pediatrician's role. Clin Pediatr (Phila) [Internet]. 2008;47(6):535–45. Available from: <http://dx.doi.org/10.1177/0009922807313272>.
3. Curtin MJ, Willis DR, Enneking B. Specific learning disabilities: The family physician's role. Am Fam Physician. 2019;100(10):628–35.
4. Hagerman RJ. Pediatric assessment of the learning-disabled child. J Dev Behav Pediatr [Internet]. 1984;5(5):274–84. Available from: <http://dx.doi.org/10.1097/00004703-198410000-00009>.
5. Horowitz SH, Rawe J, Whittaker MC. The State of Learning Disabilities: Understanding the 1 in 5. National Center for Learning Disabilities. 2017.
6. Chieffo DPR, Arcangeli V, Moriconi F, Marfoli A, Lino F, Vannuccini S, et al. Specific learning disorders (SLD) and behavior impairment: Comorbidity or specific profile? Children (Basel) [Internet]. 2023;10(8). Available from: <http://dx.doi.org/10.3390/children10081356>.
7. Chung PJ, Patel DR, Nizami I. Disorder of written expression and dysgraphia: definition, diagnosis, and management. Transl Pediatr [Internet]. 2020;9(S1):S46–54. Available from: <http://dx.doi.org/10.21037/tp.2019.11.01>.
8. Sanfilippo J, Ness M, Petscher Y, Rappaport L, Zuckerman B, Gaab N. Reintroducing dyslexia: Early identification and implications for pediatric practice. Pediatrics [Internet]. 2020;146(1).

Available from: <http://dx.doi.org/10.1542/peds.2019-3046>.

9. Erbeli F, Rice M, Paracchini S. Insights into dyslexia genetics research from the last two decades. *Brain Sci* [Internet]. 2021;12(1):27. Available from: <http://dx.doi.org/10.3390/brainsci12010027>.
10. Shaywitz SE, Shaywitz JE, Shaywitz BA. Dyslexia in the 21st century. *Curr Opin Psychiatry* [Internet]. 2021;34(2):80–6. Available from: <http://dx.doi.org/10.1097/ycp.0000000000000670>.
11. Ozernov-Palchik O, Gaab N. Tackling the “dyslexia paradox”: reading brain and behavior for early markers of developmental dyslexia. *Wiley Interdiscip Rev Cogn Sci* [Internet]. 2016;7(2):156–76. Available from: <http://dx.doi.org/10.1002/wcs.1383>.
12. Catts HW, Fey ME, Zhang X, Tomblin JB. Estimating the risk of future reading difficulties in kindergarten children: A research-based model and its clinical implementation. *Lang Speech Hear Serv Sch* [Internet]. 2001;32(1):38–50. Available from: [http://dx.doi.org/10.1044/0161-1461\(2001/004\)](http://dx.doi.org/10.1044/0161-1461(2001/004)).
13. Schutz D. The Common Core State standards for English language arts & literacy in history/social studies, science, and technical subjects: An analysis and an alternative. In: *Social Studies, Science, and Technical Subjects: An Analysis and an Alternative*. p. 15.
14. Biotteau M, Danna J, Baudou E, Puyjarinet F, Velay J-L, Albaret J-M, et al. Developmental coordination disorder and dysgraphia: signs and symptoms, diagnosis, and rehabilitation. *Neuropsychiatr Dis Treat* [Internet]. 2019;15:1873–85. Available from: <http://dx.doi.org/10.2147/ndt.s120514>.
15. Agostini F, Zoccolotti P, Casagrande M. Domain-general cognitive skills in children with mathematical difficulties and dyscalculia: A systematic review of the literature. *Brain Sci* [Internet]. 2022;12(2):239. Available from: <http://dx.doi.org/10.3390/brainsci12020239>.
16. Kaufmann L, Aster M von. The diagnosis and management of dyscalculia. *Dtsch Arztebl Int* [Internet]. 2012; Available from: <http://dx.doi.org/10.3238/arztebl.2012.0767>.

#### CORRESPONDENCE TO

Inês Gandra  
Department of Pediatrics  
Unidade Local de Saúde de Matosinhos  
Rua Dr. Eduardo Torres  
4454-509 Matosinhos  
Email: inesgandra6@gmail.com

Received for publication: 07.11.2023

Accepted in revised form: 12.02.2025