

## Review Article

# From the classroom to the clinic: a pedagogical perspective on attention-deficit/hyperactivity disorder in Mexican children and adolescents

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## ABSTRACT

Attention deficit/hyperactivity disorder (ADHD) is the most frequently diagnosed neurobehavioral condition of childhood, and the classroom, not the consulting room, is usually where its consequences are first noticed. In Mexico, school-based screening studies using the Conners 3 scale have identified probable ADHD in roughly one in six primary school children, yet fewer than three in four screened-positive families ever complete a full evaluation, and among children who do reach specialized services, seven in ten receive a diagnosis later than clinically desirable. This narrative review synthesizes epidemiological, neurobiological, and educational evidence generated chiefly in Mexican and Latin American populations to examine ADHD from a pedagogical standpoint, and how the disorder disrupts executive, academic, and socio-emotional functioning, how teachers function, in practice, as the earliest and most consistent filter for detection, despite receiving little formal training in neurodevelopmental disorders and despite a demonstrated tendency to under-recognize the quieter, inattentive presentations more common in girls, how family explanatory beliefs and a fragmented referral pathway between schools and specialized mental health services compound these delays, and how Mexican specific tools and programs, including the FX-II functional-impairment scale and the CLS-R-FUERTE school-based training program, are beginning to close this gap. We argue that improving outcomes for Mexican children with ADHD depends as much on strengthening the bridge between the education and health sectors as on any further refinement of pharmacological treatment, which is already comparatively well established, and propose specific, evidence-consistent elements of an integrated pedagogical-clinical model adapted to Mexican public education.

**Keywords:** Attention deficit disorder with hyperactivity, Mexico, Education, School teachers, Neurodevelopmental disorders, Child

## INTRODUCTION

Attention deficit/hyperactivity disorder (ADHD) is defined by a persistent pattern of inattention and/or hyperactivity impulsivity which interferes with functioning or development, with onset before age 12 and expression across at least two settings, most commonly home and school.<sup>1</sup> It is not a rare condition: an updated systematic review and meta-regression covering three

decades of epidemiological studies estimated a worldwide prevalence approaching 7% in children and adolescents, with no evidence that Latin American populations are structurally spared.<sup>2</sup>

For a Mexican neurologist or paediatrician, ADHD is therefore not an exotic diagnosis reserved for the occasional consultation; it is a condition that a classroom teacher, on any given morning, is statistically likely to be

managing informally in at least one or two students, whether or not a formal diagnosis has ever been made.

This observation provides a starting point for understanding ADHD in Mexico and other countries. Most of the existing literature approaches the disorder from the clinical perspective, focusing mainly on diagnostic criteria, comorbidities, and pharmacological treatment. This evidence is important, and in Mexico there is also a clinical practice guideline for the detection, diagnosis, and treatment of ADHD in primary care, which was most recently updated in 2022.<sup>3</sup>

However, focusing only on the clinical aspects of ADHD overlooks where the disorder has a major impact in the daily lives of Mexican children, the classroom. In many cases, the teacher is the first person to notice changes in attention or behavior. The effects of inattention and impulsivity can become more evident at school, where children may have difficulty completing assignments, receive disciplinary reports, or perform below their actual intellectual abilities. Mexican education authorities have also recognised this issue. Children with ADHD are included among those who may require specialised support through the Servicios de Apoyo a la Educación Regular (USAER), which aims to address barriers to learning and participation within regular classrooms.<sup>4</sup> As a result, ADHD in Mexico involves two systems that often work separately: the health sector, which focuses on diagnosis, specialist referral, and medication, and the education sector, which focuses on school curricula, grade levels, and educational assessment. Neither system alone can fully address a condition that affects how a child responds to the demands of the classroom.

A pedagogical perspective does not replace the clinical approach; rather, it complements it. It helps us understand not only whether a child meets the diagnostic criteria for ADHD, but also how the condition affects their daily performance at school and what specific difficulties they face in the classroom. This narrative review brings epidemiological, neurobiological, and educational evidence from Mexico and Latin America, along with relevant international studies, to examine ADHD in Mexican children and adolescents from an educational perspective. We discuss how ADHD is identified in Mexican schools, the factors that influence its detection, and the neurobiological and environmental factors associated with the disorder. We also examine its effects on academic performance, executive functions, and social and emotional development. Particular attention is given to the role of teachers, who are often the first to notice possible symptoms, as well as the barriers that can delay the process from the initial concern at school to a formal diagnosis by a specialist.

## METHODS

This is a narrative, non-systematic review that primarily focuses on evidence from Mexican populations, followed

by studies from Latin America and Hispanic populations. International studies were also included when they provided useful information about mechanisms, methods, or comparisons that were not available in the Mexican literature. We searched PubMed/MEDLINE, Scopus, SciELO, and LILACS for studies published between 2006 and 2026. The search combined the terms “attention deficit hyperactivity disorder,” “ADHD,” or “trastorno por déficit de atención” with terms such as “Mexico,” “school,” “teacher,” “education,” “prevalence,” “screening,” “diagnosis,” “intervention,” and “pedagog\*.” Reference lists of relevant articles were also reviewed to identify additional Mexican and Latin American studies that were not found through the electronic searches.

The current Mexican clinical practice guideline for ADHD from the Catálogo Maestro de Guías de Práctica Clínica, as well as educational guidance on the operation of USAER services, were also reviewed to provide the clinical and educational context of the Mexican setting. Studies were given greater priority when they included Mexican children or adolescents, school-age populations, or Hispanic/Latino populations, or when they examined genetic, environmental, or social factors relevant to ADHD in these populations.

Because this was a narrative review, no formal quality assessment or meta-analysis was performed. When the quality or certainty of the evidence had already been evaluated in previous studies, such as for methylphenidate, those assessments were reported rather than repeating the results of individual clinical trials.

## *Epidemiology in Mexican schoolchildren*

Population-based prevalence in the general population varies considerably depending on who provides the information and which assessment tools are used. Mexico shows the same pattern. One of the most relevant studies was a large screening study conducted in 55 randomly selected public elementary schools in two areas of Mexico City. The study used short versions of the Conners 3 scale, completed by both parents and teachers of 3,985 second-grade students.<sup>5</sup> When information from both parents and teachers was taken into account, the study identified 458 probable cases, corresponding to a screening prevalence of 16%. A hyperactive presentation was the most common in both boys and girls, and overall prevalence was higher among boys. This finding is similar to the 15.5% prevalence reported in a large population-based study from the United States that included 7,587 elementary-school children and used teacher DSM-IV checklists together with structured interviews with parents.<sup>6</sup> Both estimates are higher than the approximately 5–7% prevalence commonly reported in community-based studies a discrepancy that likely reflects the sensitivity, rather than the specificity, of school-based screening; teachers and parents flag considerably more children as having probable symptoms than ultimately receive a confirmed specialist diagnosis.<sup>2</sup> In the Mexico City study, 351 of the

458 families with a positive screening result (76%) accepted a referral for further evaluation. However, only 150 children completed a full psychological assessment. Of the 127 children who were eventually evaluated by a child psychiatrist, ADHD was confirmed in 72%. In the remaining cases, 18% were diagnosed with a neurological condition and 13% with another psychiatric disorder.<sup>5</sup>

Patterns of ADHD detection also vary by sex and subtype, which is important in the school setting. In the same Conners 3 study, learning difficulties and executive-function problems were more common in boys with the inattentive presentation and in girls with the combined presentation. Aggressive behavior was more frequent among boys with the hyperactive presentation. These findings suggest that children with ADHD do not all show the same difficulties in the classroom, so educational support should be adapted to each child's specific needs.<sup>5</sup> Even before children start formal schooling, teachers may be better at identifying possible ADHD symptoms than parents. In a preschool study using the Early Childhood Inventory-4, teachers identified DSM-IV ADHD criteria in 32% of children, compared with 17% identified by parents. Teacher ratings also showed a significant correlation with the Conners Rating Scales-Revised, an independent validated assessment completed six months later.<sup>7</sup> In clinical populations, rather than screening studies, the findings are somewhat different. A study of 150 children aged 8-15 years with an established ADHD diagnosis at a tertiary-care hospital in Puebla found that the combined presentation was the most common (64.7%). All of the children were receiving medication, and 65% also met criteria for an anxiety disorder. Anxiety in the children was also associated with anxiety symptoms in their parents.<sup>8</sup>

### ***Neurobiological and environmental contributors***

ADHD is a neurodevelopmental condition with a strong genetic component, but most genetic studies have been conducted in populations of predominantly European ancestry. A genome-wide association study that included Colombian and Mexican cohorts did not identify any genome-wide-significant variants. However, it found a possible association between genetic ancestry and ADHD risk, particularly with the European ancestral component. The authors also highlighted the limited representation of admixed Latin American populations in current genetic databases, which makes it difficult to apply these findings directly to populations such as Mexican children.<sup>9</sup> This limitation is important because genetic and neuroimaging findings obtained in other populations may not necessarily apply in the same way to Mexican children. It also highlights the importance of studying environmental factors that may be particularly relevant in Mexico.

Several environmental exposures have been studied in Mexican populations. In the ELEMENT birth cohorts from Mexico City, blood lead levels in children with low-level exposure ( $\leq 5$   $\mu\text{g/dL}$ ) were associated with more

hyperactive and impulsive symptoms, although no clear association was found with inattentive symptoms when assessed using the Conners Rating Scales.<sup>10</sup> A separate clinical study found that nearly half of children with confirmed ADHD had blood lead levels above the threshold established by the Mexican standard NOM-199-SSA1-2000.<sup>11</sup>

Other prenatal exposures have also been investigated. In the same Mexico City cohort, higher maternal urinary fluoride levels during pregnancy were associated with higher overall ADHD symptom scores in children assessed between 6 and 12 years of age, although no specific association with hyperactivity was found on structured testing.<sup>12</sup> Prenatal exposure to organophosphate pesticides, estimated from maternal urinary metabolites during the third trimester, was also associated with a possible increase in attention problems reported by parents when children were five years old. However, this association did not remain statistically significant across all analyses.<sup>13</sup>

### ***Beyond symptoms***

Although ADHD is diagnosed based on behavioural symptoms, its effects in the classroom involve cognitive, academic, and emotional difficulties. In a study of Mexican schoolchildren with and without ADHD, children with ADHD performed worse on several subtests of the Wechsler Intelligence Scale for Children that required visuospatial organisation and sequencing, including picture arrangement, block design, and object assembly. The inattentive presentation showed the greatest differences in both performance and total IQ compared with children without ADHD.<sup>14</sup>

The emotional impact of ADHD is also important, using a validated pictorial quality-of-life questionnaire, the same Mexican research group found lower quality-of-life scores in children with ADHD compared with healthy controls (45.2 vs. 54.3). Lower quality of life was also associated with higher anxiety scores on a validated anxiety scale for children.<sup>15</sup> These difficulties can also affect the family environment. In the Puebla study mentioned above, the child's anxiety was significantly associated with anxiety in the parent, suggesting that emotional difficulties may extend beyond the classroom and influence the home environment.<sup>8</sup>

A retrospective study of more than 7,000 pediatric medical records from a predominantly Hispanic population living near the US-Mexico border found that children with ADHD were more likely to be underweight and did not show a significant association between ADHD and obesity.<sup>16</sup> This differs from findings reported in some non-Hispanic populations. The broader point is that the characteristics and associated problems of ADHD may vary between populations. Therefore, evidence from Mexican and Hispanic populations should be considered whenever available, particularly when findings from other populations lead to different conclusions.

***The teacher as gatekeeper***

If Mexican teachers are often in a good position to identify ADHD early, the available evidence also shows that this does not happen consistently. In a Mexico City study that followed 177 caregiver-child pairs through five stages, from the first recognition of symptoms to formal diagnosis, the school was the only factor identified as facilitating timely diagnosis. Teachers were usually the first adults to notice that a child was having difficulties and to encourage parents to seek professional help.<sup>17</sup> However, teachers were more likely to recognise hyperactive and impulsive behaviours in boys than inattentive symptoms in girls. As a result, the diagnostic process for girls started and ended approximately one to one and a half years later than for boys.<sup>17</sup>

The reasons for these differences have also been studied. An international vignette study included 418 practising K-12 teachers from 15 countries, including Mexico.<sup>18</sup> Teachers were shown the same examples of inattentive and hyperactive behaviour, but their ratings of severity varied according to their teaching experience, previous ADHD training, cultural orientation, knowledge of ADHD, and beliefs about the disorder. Greater knowledge of ADHD and fewer negative beliefs were associated with more accurate assessments. Overall, factual knowledge was only moderate, with teachers answering approximately 64% of the questions correctly. Teachers who expressed a need for additional training also tended to provide more accurate ratings. Cultural factors may also influence how teachers interpret behaviour. In more collectivist cultural settings, behaviours that disrupt group harmony may receive more attention than less visible problems such as inattention. This could contribute to the under recognition of inattentive symptoms, particularly among girls.<sup>18</sup>

Similar differences have been observed among families. A mixed-methods study of Latino families receiving school-based services for attention and behavioural concerns found that some Spanish-speaking parents interpreted ADHD-related behaviours as being related to family dynamics, parenting, discipline, or the child's temperament rather than as symptoms of a neurodevelopmental disorder. These explanations were associated with differences between parents and teachers in their assessment of the child's level of impairment.<sup>19</sup>

When teachers do not have enough knowledge or confidence to identify concerning behaviours, and parents have other explanations for those behaviours, the two factors can reinforce each other. As a result, difficulties may be considered part of the child's normal behaviour or family life instead of leading to a formal evaluation.

This should not be interpreted as a failure of teachers or parents. Rather, it reflects the need for better training and clearer communication between schools, families, and healthcare professionals so that children with possible ADHD can be identified and supported earlier.

***From the classroom to the consulting room***

Recognising possible ADHD at school is only the first step in a longer process before a child receives a formal diagnosis. Studies of healthcare pathways have shown that this process depends not only on the severity of symptoms, but also on how healthcare and educational services are organised.<sup>20</sup> In the Mexico City study, the longest delay occurred between the moment caregivers first noticed that something was wrong and the decision to seek help from a mental-health professional. This period lasted approximately one year for both boys and girls. The authors suggested that this delay was mainly related to caregivers not recognising inattention, hyperactivity, or impulsivity as possible signs of a mental-health or neurodevelopmental problem, rather than an intentional decision to avoid healthcare.<sup>17</sup>

Another year, on average, passed between the first contact with a mental-health professional and the completion of the diagnosis. Overall, 71% of the families experienced a diagnosis considered late, significantly late, or highly late compared with the proposed optimal diagnostic age of 4.5 years. Fewer than one in three children were diagnosed within this period, and only one boy in the entire study was diagnosed at or before the optimal age; no girls were. Children with more siblings tended to experience longer delays, possibly because caregivers had less time and resources available for each child. In contrast, children whose caregivers had formal employment were diagnosed sooner, which may reflect better access to healthcare and greater health-system knowledge.<sup>17</sup>

This problem is particularly relevant because Mexican educational policy already gives USAER teams a role in the psychopedagogical evaluation of children with barriers to learning and participation, including those related to conditions such as ADHD.<sup>4</sup> In principle, this provides an opportunity for early evaluation within the school setting. However, the available evidence suggests that the educational and health systems continue to operate largely separately. USAER's educational assessment pathway and the clinical diagnostic pathway guided by CENETEC do not appear to be connected by a consistent referral and counter-referral process. This can make it difficult for a concern identified at school to reach specialised care, and for a confirmed diagnosis to be translated into appropriate classroom support.

Another issue that deserves attention is the age of children within the same school grade. A scoping review of school-entry age and health outcomes in low- and middle-income countries found that children who were younger than most of their classmates were more likely to be rated by teachers as having ADHD symptoms and were also more likely to receive an ADHD diagnosis or medication. Similar findings have been reported in countries such as Brazil and Türkiye.<sup>21</sup> This relative-age effect may partly reflect normal developmental differences being interpreted as symptoms of ADHD. For example, a child who has

recently turned six may be expected to perform alongside classmates who are several months older and developmentally more mature.

### ***School-based and culturally adapted interventions***

The barriers described above are not impossible to change, and a small but growing number of studies in Mexico provide examples of how some of these problems could be addressed. One of the most developed examples is the Collaborative Life Skills program, originally developed in the United States and later adapted for Mexican public schools as CLS-FUERTE. A remote version, CLS-R-FUERTE, was evaluated in three public elementary schools in Sinaloa. The study included 67 children between 6 and 12 years of age with attention or behavioural difficulties, together with their parents, teachers, and school-based clinicians. The program showed good adherence to the planned intervention, and satisfaction ranged from 71% to 100% among parents, teachers, and students, depending on the school. Improvements were also observed in ADHD symptoms and functional impairment reported by both parents and teachers. These changes were similar in size to those previously reported with the in-person program.<sup>22</sup>

The importance of this study is not so much the size of the reported effects, since the study did not include a control group, but rather the possibility of delivering this type of intervention remotely. Training and coaching through teleconsultation could make it possible to support several schools without requiring a specialist to be physically present in each one. This may be particularly useful in Mexico, where child psychiatry and neurology specialists are concentrated mainly in a limited number of large cities.

Another important development is the FX-II scale, a 52-item Spanish-language instrument designed specifically to assess academic, social, emotional, and family functioning in Mexican children with ADHD. The scale was validated in a combined sample of 191 Mexican parents and teachers.<sup>23</sup> Unlike instruments simply translated from English, the FX-II was developed around areas that Mexican families and teachers identified as important. One of the most frequently reported concerns was poor academic performance or low grades. The instrument showed good reliability as well as convergent and predictive validity.<sup>23</sup> From an educational perspective, tools such as the FX-II can help teachers and clinicians describe the specific difficulties a child experiences at school and at home, rather than focusing only on the number or frequency of ADHD symptoms.

Medication continues to have an important role in ADHD treatment, but it should not be considered a complete solution to the difficulties experienced at school. A Cochrane systematic review of methylphenidate in children and adolescents with ADHD found improvements in core ADHD symptoms and teacher-rated general behaviour. However, the certainty of the evidence was

considered low, mainly because of methodological limitations related to blinding and the recognisable adverse effects of the medication.<sup>24,25</sup> Mexican clinical trials comparing immediate-release and extended-release methylphenidate have also reported improvements in Conners scale scores reported by parents and teachers, as well as changes in quantitative EEG measures after one month of treatment. Both formulations showed broadly similar effectiveness.<sup>26</sup> Importantly, pharmacological studies do not usually evaluate whether treatment changes the child's classroom environment, teacher expectations, academic support, or learning strategies. These are the areas addressed by functional assessment tools and school-based programs such as CLS-R-FUERTE. Therefore, educational interventions should not be viewed as alternatives to medication, but as complementary components of a broader approach to ADHD care.

### ***Integrated pedagogical clinical model for Mexico***

Taken together, the evidence suggests five main priorities for Mexican schools and the health services that support them. First, teachers should receive structured training on ADHD, including how to recognise inattentive symptoms and the fact that these symptoms may be less noticeable in girls. This training should be included both in teacher education at the escuelas normales and in continuing professional education, since previous studies show that teachers' knowledge and attitudes influence how they interpret children's behaviour.<sup>18</sup>

Second, the referral process between schools and healthcare services needs to be improved. The lack of an effective referral and counter-referral system was identified as one of the main barriers to timely diagnosis in Mexico City.<sup>17</sup> A clearer connection between USAER's psychopedagogical evaluation and the diagnostic pathway established in the national clinical practice guideline could help ensure that children identified at school receive an appropriate evaluation without unnecessary delays.<sup>3,4,17</sup>

Third, schools could incorporate validated Spanish-language screening and functional assessment tools into their evaluation processes. Instruments such as the Conners 3 and ECI-4, together with functional assessment tools such as the FX-II, can provide information from both teachers and parents and help identify how ADHD affects the child's academic and daily functioning.<sup>5,7,23</sup> Their use is particularly relevant because they have been evaluated in Mexican or Spanish-speaking populations.

Fourth, technology-based training and coaching programs such as CLS-R-FUERTE should be further studied and, if their effectiveness is confirmed, expanded to other regions of the country.<sup>22</sup> Remote programs may be especially useful for schools located far from specialised healthcare services.

Fifth, the effect of school-entry age should be considered when evaluating possible ADHD. The relative-age effect

suggests that children who are younger than most of their classmates may be more likely to be identified as having ADHD symptoms.<sup>21</sup> At a minimum, the child's age relative to the rest of the class should be considered before a concern raised by a teacher leads to a formal diagnostic evaluation.

These priorities do not depend on developing new medications or on major changes to pharmacological treatment. They focus mainly on how schools identify, evaluate, support, and refer children with possible ADHD. In this sense, they represent educational as well as health interventions. Improving outcomes for Mexican children with ADHD therefore requires not only appropriate clinical care, but also changes in teacher training, school-based assessment, referral processes, and educational policies. These areas should be adequately studied and considered an important part of the national response to ADHD.

## DISCUSSION

Taken together, the Mexican and Latin American literature reviewed in this study presents a relatively consistent picture, despite the separation that still exists between the health and education systems. ADHD is common among Mexican schoolchildren, with reported prevalence similar to some of the higher estimates from other countries. Teachers often play an important role in identifying children with possible ADHD and are frequently the first adults to notice difficulties with attention or behaviour. The main challenges do not appear to be a lack of effective treatment, but rather limited teacher training, differences in how children's behaviours are interpreted, and the lack of a clear connection between educational assessment and clinical diagnosis.

However, these findings should be interpreted with some caution. Most of the available studies were conducted in Mexico City, Puebla, or Sinaloa, often in a single hospital or a limited number of public schools. Rural communities, southern states, and Indigenous populations are poorly represented in the literature. This lack of representation is important because it limits how confidently the findings can be applied to the entire Mexican population. It also reflects, at the population level, some of the same limitations described in genetic studies, where Latin American and admixed populations remain underrepresented.<sup>9</sup>

Most of the studies included in this review were cross-sectional, which limits the ability to establish cause-and-effect relationships. This is particularly relevant for studies of environmental exposures, where associations do not necessarily demonstrate causality. The evidence for pharmacological treatment also needs to be interpreted carefully. Although methylphenidate has demonstrated benefits for core ADHD symptoms, the certainty of the available evidence has been considered low in systematic reviews.<sup>24</sup> These limitations highlight the need for caution

when interpreting the evidence, rather than assuming that current approaches are fully established.

The findings also point to several specific areas for future research. Mexico needs prospective, multicentre studies that follow children from the first identification of difficulties by teachers through specialist assessment and treatment. These studies should evaluate not only ADHD symptoms but also outcomes that are directly relevant to education, such as academic performance, grade repetition, and school dropout. These outcomes are particularly important because the main goal of a school-based intervention is not simply to reduce symptom scores, but to improve the child's functioning and participation at school.

School-based interventions such as CLS-R-FUERTE also need to be evaluated in controlled studies rather than only in feasibility trials.<sup>22</sup> Similarly, teacher-training programmes should be tested using methods that directly measure whether training improves the identification of ADHD symptoms. The vignette methodology used in international research could be adapted for larger studies involving teachers from different regions and educational settings in Mexico.<sup>18</sup>

Until this evidence becomes available, the priorities identified in this review should be considered a practical starting point rather than a definitive model. Improving the identification and management of ADHD in Mexican children will likely require closer collaboration between schools, families, and healthcare professionals, together with research that evaluates whether these changes actually improve academic and functional outcomes.

## CONCLUSION

ADHD in Mexican children is not an uncommon or isolated clinical problem. It is a frequent concern in the public-school setting, where teachers are often the first to notice difficulties with attention and behaviour. What happens after that first concern depends on several factors, including teacher training, family understanding of ADHD, and the ability of the education and healthcare systems to work together.

Although the clinical evidence for ADHD treatment is relatively well established, important gaps remain in the educational and referral systems needed to ensure that children receive timely evaluation and appropriate support at school. Addressing these gaps requires more than clinical care. Greater attention should be given to teacher training, school-based identification, functional assessment, and clear referral pathways between schools and healthcare services.

The goal should be to ensure that a teacher's concern about a child becomes the beginning of an effective process of evaluation and support, rather than the point where that process is lost.

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