Arq Neuropsiquiatr 2006;64(4):932-936

ECI-4 SCREENING OF ATTENTION DEFICIT-HYPERACTIVITY DISORDER AND CO-MORBIDITY IN MEXICAN PRESCHOOL CHILDREN

Preliminary results

Adrián Poblano[1], Erika Romero[2]

ABSTRACT - *Objective:* To examine prospectively usefulness of Early Childhood Inventory-4 (ECI-4) in identifying attention deficit-hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), and conduct disorder (CD). *Method:* A sample of children <6 years of age were evaluated in school settings with ECI-4 and results compared with those of Conners Rating Scales-Revised (CRS-R) 6 months later. Sample consisted of 34 healthy children (20 boys, 14 girls) prospectively followed-up. *Results:* Frequency of children fulfill DSM-IV AD-HD criteria in ECI-4 parent scale was 17%, and in teacher scale was 32%. Frequency of children fulfill DSM-IV AD-HD criteria in parent CRS-R was 20%, and for teacher questionnaire was 23%. Correlations were significant among teacher ECI-4 and both teacher and parent CRS-R scales. Sensitivity and specificity of teacher and parent ECI-4 scales were not good. Frequency of ODD identified in parent ECI-4 scale was 5%, and for teacher 17%. Frequency of ODD in CRS-R for parents and teachers questionnaires was 17%. CD was not identified by parents in ECI-4 scale, but in teacher scale frequency was 14%. *Conclusion:* These facts support partially the use of ECI-4 screening of ADHD in Spanish–speaking preschool children.

KEY WORDS: preschool children, hyperactive children, disruptive behavior, screening.

Tamizaje del trastorno por déficit de atención-hiperactividad y su co-morbilidad en preescolares mexicanos por el ECI-4: resultados preliminares

RESUMEN - *Objetivo:* Examinar prospectivamente la utilidad del Inventario Temprano de la Niñez-4 (Early Childhood Inventory-4, ECI-4) para identificar el trastorno por déficit de atención-hiperactividad (TDAH), el trastorno desafiante-oposicional (TDO) y el trastorno de conducta (TC). *Método:* Una muestra de niños <6 años fue evaluada con el ECI-4 en un ambiente escolar y los resultados comparados con los de las Escalas de Conners (Conners Rating Scales-Revised, CRS-R) 6 meses mas tarde. La muestra consistió de 34 niños (20 niños, 14 niñas) seguidos prospectivamente. *Resultados:* La frecuencia de niños que llenaron los criterios del DSM-IV para TDAH en la escala para padres del ECI-4 fue 17%, mientras que en la escala para maestros fue 32%. La frecuencia de niños que llenaron los criterios del DSM-IV para TDA-H en la escala para padres CRS-R fue 20%, en la escala para maestros fue 23%. Se hallaron correlaciones significativas entre la escala para maestros del ECI-4 y las escalas para maestros y para padres de CRS-R. La sensibilidad y la especificidad de las escalas para maestros y padres del ECI-4 no fueron alentadoras. La frecuencia del TDO identificada en la escala para padres del ECI-4 fue 5% y en la escala para maestros fue 17%. La frecuencia del TDO en la escala para padres y para maestros CRS-R fue 17%. El TC no fue identificado por los padres con la escala del ECI-4, pero en la escala para maestros, la frecuencia fue de 14%. *Conclusión:* Los resultados obtenidos apoyan parcialmente el uso de las escalas de tamizaje del ECI-4 para encontrar TDAH, TDO y TC en preescolares mexicanos.

PALABRAS CLAVE: preescolares, trastorno por déficit de atención-hiperactividad, trastorno desafiante oposicional, trastorno de conducta, tamizaje.

Attention deficit-hyperactivity disorder (ADHD) is a childhood-onset disorder whose cardinal symptoms are inattention, hyperactivity and impulsivity[1,2]. Although there are several studies on the validity, prediction and other measures of ADHD in English-speaking preschool populations[3-5], no studies have

Laboratory of Cognitive Neurophysiology, National Institute of Rehabilitation, Mexico City, Mexico, and Department of Language Therapy. Center of Rehabilitation DDF-DIF "Benito Juárez", Mexico City, Mexico: [1]MD, MSc, DSc, Neurophysiologist; [2]BSc, MSc, Speech Therapist.

Received 23 February 2006, received in final form 10 July 2006. Accepted 11 August 2006.

Dr. Adrián Poblano Calzada - México-Xochimilco 289, Col. Arenal-Guadalupe, Deleg. Tlalpan, 14389 Mexico City, Mexico. E-mail: drdyslexia@starmedia.com

been carried out for assessment of ADHD in Spanish-speaking preschool-age children, despite applicability of such early detection[6,7]. Moreover, in school settings, early identification of young children in need of special education and related services is very important[8]. Oppositional defiant disorder (ODD) is characterized by a persistent pattern of negativistic, irritable, and non-compliant behavior[1]. Symptoms can be identified as problematic at school age because cooperation with rules and routines is expected and necessary for the activities of daily life; however, during the preschool period distinction between normative and problematic behavior is much less clear-cut[9]. The essential feature of conduct disorder (CD) is a persistent pattern of violation of rules and the rights of others, including aggressiveness and destructiveness[9]. Frequency of ADHD, and ODD, and CD during the preschool period has been studied infrequently[10]. We must identify ODD and CD also as early as possible for avoiding complications and frustration in parents, teachers, and children in the hope of a better and fast therapeutic response.

The Early Childhood Inventory-4 (ECI-4) contains the behavioral symptoms of the most prevalent DSM-IV psychiatric disorders exhibited by preschool children. There are both parent and teacher versions of the ECI-4[11]. ECI-4 content awaits for prospective studies in children at different settings (clinics, schools, homes), with different languages and from different countries.

The purpose of this study was to examine clinical usefulness of the ECI-4 in identifying prospectively screening for ADHD, ODD, and CD among children <6 years of age who were evaluated in school settings and to compare results with those of Conners Rating Scale-Revised (CRS-R)[12] at least 6 months later in a sample of preschool children in Mexico City.

METHOD

Pilot study – Parent and teacher ECI-4 questionnaires were directly translated to Spanish from English version with the purpose to use the most common words and sentences talked in Spanish in Mexico City area. Ten parents and 10 teachers of children from schools of middle socioeconomic level from the southern area of Mexico City were requested to answer questionnaires. Eight children were male and two, female; nine mothers and one father answered the questionnaire. Mean age of children was 51.3 months, standard deviation (SD) 11.91 months, teacher time knowing the children was 12 months, SD 4 months, and teacher time spent with the child was per day 5.2 h, SD 1.93 h a day.

Subjects – The sample consisted of 34 healthy children invited to participate from different regular schools and classes of the southern area of Mexico City (20 boys, 14 girls) who were prospectively followed-up. ECI-4 screening was performed first and Conners Rating Scales were tested at least 6-8 months later when children were >6 years of age. When examined for the first time, the children were 5 years of age (mean 67.83 months, SD 0.77 months), teacher time knowing children was 6.8 months, SD 9 months, and teacher time spent with children was 5.7 h/day SD 1.13 h/day. Inclusion criteria were: preschool children between 66 and 71 months of age with regular school attendance. Exclusion criteria were: deafness and blindness, epilepsy, congenital malformations, and genetic syndromes.

Procedure – ECI-4 materials were mailed to parents and teachers of potential patients by school principals included rating scales, background information questionnaires, and consent documents. Parents and teachers were required to complete and return their forms anonymously but respondents indicated age, gender, and relationship to child. In the majority of cases (88%), ratings were completed by the child's mother. Six months later parents and teachers CRS-R were sent in the same manner, and results between ECI-4 and CRS-R were compared. Inclusion and exclusion criteria were identical for the study and the pilot study. Clinical diagnoses were performed in those cases fulfill DSM-IV criteria for ADHD, ODD and CD at the end of the study[13]. This investigation was approved by the Research Committee of the National Institute of Rehabilitation and informed consent was signed by parents of participating children.

Early childhood inventory-4 – The parent version of the ECI-4 contains 108 items, which correspond to the DSM-IV. Individual items are scored in two ways: symptom count (binomial), and symptom severity (semi-quantitative). For symptom count scores, a specific symptom is generally considered to be a clinically relevant problem if rated as occurring often or very often (0=never/sometimes or, 1=often/very often). When symptom count score is ≤ to number of symptoms specified by DSM-IV as necessary for diagnosis of possibility, the child receives a screening cutoff of "yes" for the disorder, nonetheless this does not signify a clinical diagnosis. For symptom severity scores, items are scored 0= never, 1=sometimes, 2=often, and 3=very often. Scores for each item are added together to generate a symptom severity score for each symptom category and for all items (total severity score). ECI-4 symptom categories are as follows: attention deficit disorder-inattention (nine items), attention deficit disorder-hyperactivity (nine items); oppositional defiant disorder (eight items); conduct disorder (10 items); generalized anxiety disorder (nine items); social phobia (two items); separation anxiety disorder (eight items, parents only); major depressive disorder (11 items); dysthymic disorder (eight items); autistic disorder (12 items), and Asperger's disorder (eight items). The teacher version of the ECI-4 contains 87 items from the parent version, but excludes symptoms not likely to be observed in the school setting[14,15].

Conners rating scale-revised – The long version of the Conners rating scale-revised was used, the parent version

contains 80 items, and the teacher version contains 59 items. Both scales were rated as ECI-4 was rated for further statistical comparisons. CRS-R items were rated as occurring often or very often (0=never/sometimes or, 1=often/very often). For symptom severity scores, items are scored 0= never, 1=sometimes, 2=often, and 3=very often. When symptom count score is ≤ to number of symptoms specified by DSM-IV as being necessary for diagnosis of possibility, the child receives a screening cutoff of "yes" for the disorder, but this does not necessarily comprise a clinical diagnosis[16,17].

Data analyses – We calculated averages and standard deviations of quantitative variables and percentages of qualitative variables. Sperman's correlations provide measurement of association among symptom severity scores of parents and teachers ECI-4 and parents and teachers CRS-R and between parent's and teacher's tests of both scales[18]. Comparison of qualitative variables was performed by chi square test, and Fisher exact test when appropriate. Level of statistical significance was ≤0.05. Sensitivity and specificity of parents and teachers version of the ECI-4 after parents and teachers CRS-R evaluation were calculated from 2 x 2 contingence table[19].

RESULTS

Data from parent and teacher respondents to the ECI-4 screening scale in the sample (n=34) are shown in Table 1; frequency of children fulfill DSM-IV criteria for ADHD after symptom count in ECI-4 parent scale was 17%, and in teacher scale was 32%. Correlation between symptom severity scores of parent and teacher ECI-4 scales was significant (rho= 0.372, p= 0.017). Questions most frequently found positive for children with ADHD in parent questionnaire was: "runs about or climbs on things when asked not to do so" (10 often/1 very often). Questions most frequently answered positively for children with ADHD in teacher questionnaire were: "has difficulty organizing task and activities" (8 often/4 very often), "is easily distracted by other things going on" (7 often/8 very often), "is forgetful in daily activities" (11 often/2 very often), "runs about or climbs on things when asked not to do so" (8 often/4 very often), and "talks excessively" (8 often/3 very often).

Results of parent and teacher CRS-R are shown in Table 2; frequency of children that fulfill DSM-IV criteria for ADHD after symptom count in parent questionnaire was 20%, and for teacher questionnaire, 23%. Correlation between symptom severity scores of parent and teacher CRS-R was also significant (rho= 0.402, p=0.018).

At last the study, four children were diagnosed as having ADHD, three of them with predominance of hyperactivity and one with combined type. Correlations among symptom severity scores of ECI-4 scales and CRS-R were significant except between parent ECI-4 and teacher CRS-R and among parent ECI-4 and parent CRS-R (Table 3). Sensitivity and specificity of teacher and parent ECI-4 scales were compared with the CRS-R, parent ECI-4 scale had sensitivity of 0.60,

Table 1. Frequency and percentage (in parentheses) of attention deficit/hyperactivity disorder (ADHD), oppositional-defiant disorder (ODD) and conduct disorder (CD) identified by symptom count (binomial) in the sample of 34 preschoolers using Early Childhood Inventory-4 Screening.

	Parent ECI-4	Teacher ECI-4	Agreement	Without disorder
ADHD	6 (17.6)	11 (32.3)	4 (11.7)	23 (67.6)
ODD	2 (5.8)	6 (17.6)	1 (2.9)	28 (82.3)
CD	–	5 (14.7)	–	29 (85.2)

Table 2. Frequency and percentage (in parentheses) of attention-deficit/hyperactivity disorder (ADHD), oppositional-defiant disorder (ODD) and conduct disorder (CD) identified by symptom count (binomial) in the sample of 34 preschoolers using Conners rating scales-revised examination (CRS-R).

	Parent CRS-R	Teacher CRS-R	Agreement	Without disorder
ADHD	7 (20.5)	8 (23.5)	4 (11.7)	26 (76.4)
ODD	6 (17.6)	6 (17.6)	3 (8.8)	28 (82.3)
CD	1 (2.9)	3 (8.8)	1 (2.9)	31 (91.1)

Table 3. Correlations of symptom severity scores of parent and teacher ratings of attention-deficit/hyperactivity disorder on the Early Childhood Inventory-4 and the Conners rating scales-revised in a sample of 34 preschool children.

	Parent ECI-4	Teacher ECI-4	Parent CRS-R
Teacher ECI-4	0.37 (0.01)		
Parent CRS-R	0.33 (0.05)	0.58 (0.001)	
Teacher CRS-R	0.10 (0.54)	0.65 (0.001)	0.40 (0.01)

specificity was 0.51; teacher ECI-4 scale has sensitivity of 0.78 while specificity was 0.56.

Frequency of children fulfill DSM-IV criteria for ODD after symptom count in parent ECI-4 scale was 5%, and for teacher 17%, agreement was present in only one subject, and correlation between scales was not significant. Frequency of children fulfill DSM-IV criteria for ODD in CRS-R after symptom count for parents and teachers was 17%, while correlation between parent and teacher scales was significant (rho=0.327, p=0.05). No children fulfill DSM-IV criteria for CD after symptom count in parent ECI-4 scale, but in teacher scale frequency was 14%. Correlation between scales can not be calculated. CD in parent after symptom count in CRS-R had a frequency of 2%, and in the teacher scale, 8%; correlation between scales was not significant. No calculations of sensitivity and specificity were performed due to insufficient data.

DISCUSSION

Significant correlations were found between teacher versions of the ECI-4 and CRS-R, but not between the parents version of the two scales. These findings support partially the use of the teacher ECI-4 to screen for ADHD in Spanish-speaking preschool children; use of the parents version of the ECI-4 as a screening test requires more supporting evidence. Frequencies of ADHD in our sample are high compared to other studies, which may reflect a bias of selection (parents of children with ADHD may be more likely to participate). ODD and CD screening by means of ECI-4 have insufficient data for any consideration, therefore, in future work we must study a large sample of children with ODD and CD to reach more power for statistical calculations.

There are many works on the convergence and divergence of parent and teacher ratings of ADHD. Differences between symptoms groups varied depending on how they were configured (teacher versus parent ratings) and settings (clinic versus community). Symptoms are most apparent for teachers-defined groups in community samples (as in our results) and parents-defined groups in clinic samples[20]. These observations can be attributed to the fact that children with ADHD exhibited more negative social behavior in school settings and scored significantly lower in teachers scales[21]. Brief time interval between ECI-4 and CRS-R application (maximum 8 months of difference) discard that differences between test can be attributed to developmental effects such as it was observed by Lahey et al.[4].

Sensitivity is defined as the capacity to differentiate between children with the disorder from those without the disorder, while specificity is better defined as the ability to differentiate children without the disorder from children with the disorder[22,23]. We calculate validity measurements of our study comparing screening tests with the psychiatric interview as the gold standard, because as everybody know screening test can not give clinical diagnoses, instead can only recognize subjects requiring a more detailed study. Measures of sensitivity and specificity in our study were not good, and support only partially the use of ECI-4 for ADHD screening when compared with psychiatric interview[11]. Thus, ECI-4 screening of ODD and CD requires more supporting evidence. The low frequency of CD symptoms is not surprising given the young age of the sample, CD symptoms are uncommon among preschool children[10].

Early detection of ADHD, ODD and CD is very convenient. Although the last revision of the DSM-IV criteria for ADHD included an age-of-onset criterion requiring that symptoms be present prior to the age of 7 years[1,24], the validity of very early ADHD diagnoses is open to debate. However, many reports find that the majority of children with diagnosis of ADHD first exhibited symptoms in early childhood[7,9,20,25]. In this sense ECI-4 screening can be useful for early detection of ADHD in Spanish-speaking children. To

our knowledge this is the first study of ECI-4 performed in Spanish-speaking children, and suggests the usefulness of continued study for application of this instrument. Thus, results from this study support partially the validity of the teacher's ECI-4 as a screening tool for ADHD in this age group.

Aknowledgments – Part of the research was the M.Sc. thesis of E. Romero. Authors wish to thanks to Ma. de Lourdes Arias M.D., for help in evaluation of children. Elsa Tirado B.Sc. and M.Sc for her comments about content of the manuscript, Maggie Brunner M.A., for help in the preparation of the manuscript in English and to Juan Poblano D.Ed., and Jovita Luna D.Ed. for partial support of the study.

REFERENCES

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 4th edition (DSM-IV). Washington: American Psychiatric Association, 1994.
2. Poblano A, Druet N, Kauffman-Janssen B, Huipe-Valencia H. Learning and attention deficit disorders in children (in Spanish). In Hernández OF, Arroyo CA, Peñaloza LY (eds). Communication disorders medicine. Mexico: National Institute of Communication Disorders, 1994:213-238.
3. Keenan K, Shaw DS, Walsh B, Delliquadri E, Giovanelli J. DSM-III-R disorders in preschool children from low-income families. J Am Acad Child Adolesc Psychiatry 1997;36:620-627.
4. Lahey BB, Pelham WE, Stein MA, et al. Validity of DSM-IV attention-deficit/hyperactivity disorder for younger children. J Am Acad Child Adolesc Psychiatry 1998;37:695-702.
5. Lahey BB, Pelham WE, Loney J, et al. Three-year predictive validity of DSM-IV attention-deficit hyperactivity disorder in children diagnosed at 4-6 years of age. Am J Psychiatry 2004;161:2014-2020.
6. Ramey CT, Campbell FA, Ramey SL. Early intervention: successful pathways to improve intellectual development. Dev Neuropsychol 1999;16:385-392.
7. Willoughby MT, Curran PJ, Costello EJ, Angold A. Implications of early versus late onset of attention-deficit/hyperactivity disorder symptoms. J Am Acad Child Adolesc Psychiatry 2000;39:1512-1519.
8. Fletcher TV, Klinger Kaufman de Lopez C. A Mexican perspective on learning disabilities. J Learn Disab 1995;28:530-534.
9. Keenan K, Wakschlag LS. Can a valid diagnosis of disruptive behavior disorder be made in preschool children? Am J Psychiatry 2002;159: 351-358.
10. Wilens TE, Biederman J, Brown S, et al. Psychiatric comorbidity and functioning in clinically referred preschool children and school-age youths with ADHD. J Am Acad Child Adolesc Psychiatry 2002;41:262-268.
11. Sprafkin J, Volpe RJ, Gadow KD, Nolan EE, Kelly K. A DSM-IV-referenced screening instrument for preschool children: the Early Childhood Inventory-4. J Am Acad Child Adolesc Psychiatry 2002;41:604-612.
12. Conners K. Clinical use of rating scales in diagnosis and treatment of attention-deficit/hyperactivity disorder. Pediatr Clin N Am 1999;46: 857-870.
13. Angold A, Prendergast M, Cox A, Harrington R, Rutter M. The child and adolescent psychiatric assessment (CAPA). Psychol Med 1995;25: 739-753.
14. Gadow KD, Sprafkin J. Early chilhood inventory-4 screening manual. New York: Checkmate Plus, 2000.
15. Gadow KD, Sprafkin J. Early chilhood inventory-4 norms manual. New York: Checkmate Plus, 2000.
16. Conners K, Sitarenios G, Parker J, Epstein J. Revision and restandardization of the Conners teacher rating scale (CTRS-R): factor structure, reliability, and criterion validity. J Abnorm Child Psychol 1998;26:279-291.
17. Conners K, Sitarenios G, Parker J, Epstein J. Revision and restandardization of the Conners parent rating scale (CPRS-R): factor structure, reliability, and criterion validity. J Abnorm Child Psychol 1998;26:257-268.
18. Daniel WW. Biostatistics: a foundation for analysis in the health sciences (in Spanish). Mexico: Limusa, 1989.
19. Dawson-Saunders B, Trapp RG. Basic and clinical biostatistics (in Spanish). Mexico: Manual Moderno, 1997.
20. Gadow KD, Nolan EE. Differences between preschool children with ODD, ADHD and ODD+ADHD symptoms. J Child Psychol Psychiatry 2002;43:191-201.
21. DuPaul GJ, McGoey KE, Eckert TL, VanBrankle J. Preschool children with attention-deficit/hyperactivity disorder: impairments in behavioral, social, and school functioning. J Am Acad Child Adolesc Psychiatry 2001;40:508-515.
22. Feinstein AR. Clinimetrics. New Haven: Yale University Press, 1987.
23. Browner WS, Newman TB, Cummings SR. Design a new study: III. Diagnostic test (in Spanish). In Hulley SB, Cummings SR (eds). Clinical research: an epidemiologic approach. Madrid: Harcourt Brace 1997:97-107.
24. American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 3rd edition-revised (DSM-III). Washington: American Psychiatric Association, 1987.
25. Gadow KD, Nolan EE, Litcher L, et al. Comparison of attention-deficit/hyperactivity disorder symptoms subtypes in Ukranian schoolchildren. J Am Acad Child Adolesc Psychiatry 2000;39:1520-1527.