The Development of an Educational and Screening Instrument for Attention Deficit Hyperactivity Disorder in a Pediatric Residency Program

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Abstract

Background. Numerous indices determine the presence of ADHD, but no screening instrument exists which would direct a more detailed evaluation that is designed specifically for pediatric residents. This article presents the development and assessment of a screening instrument for the assessment of Attention Deficit Hyperactivity Disorder (ADHD) in a pediatric residency program.

Methods. Pediatric resident physicians were assessed by survey regarding their comfort levels in taking an ADHD assessment before and after the introduction of a screening instrument. The Pediatric Residency Checklist (PRC)/ADHD was developed specifically for educational use. Its reliability and validity was assessed for its use by residents as a screening tool for ADHD.

Results. At a PRC/ADHD score of 10 or higher, 88.9% of patients were classified correctly as having ADHD or not having ADHD. The sensitivity for ADHD diagnosis was 94.4% and the specificity was 81.5%. The positive likelihood ratio using was 5.1. The negative likelihood ratio was 0.07. The odds ratio of predicting an ADHD diagnosis was 40.4, controlling for age and gender. Residents were more comfortable in their assessments and treatment of ADHD after instruction in the application and use of the Pediatric Resident Checklist/ADHD.

Conclusions. The results showed the viability of the PRC/ADHD as a screening device for ADHD, especially in the day-to-day operations of a pediatric residency clinic. The addition of the Pediatric Residency Checklist/ADHD benefitted residents in terms of increased comfort levels in the assessment and treatment of ADHD. *KJM 2008; 1(4):70-80.*

Introduction

Approximately 15% to 18% of children in the United States have developmental or behavioral disabilities.[1] Of these disorders, Attention Deficit Hyperactivity Disorder (ADHD) is one of the most commonly diagnosed, accounting for 30%-40% of all referrals to child guidance clinics.[2] Additionally, the different presentations of ADHD make it difficult for even experts in the field to define let alone diagnose. In the past, clinicians have characterized the disorder as "organic driven-ness", "minimal brain dysfunction", and more recently Attention Deficit Hyperactive Disorder.[3]

Although actual prevalence of the disorder is debated, most current research suggests that 2-5% of school-aged children have well defined and pervasive symptoms.[4] ADHD may be both under- and over-diagnosed, leading to concern with reference to how exactly we approach its diagnosis in the medical field.[5] Finally, there may be gender issues that result in both under- and over-diagnosis for girls and boys respectively.[6] Clearly, there is an emerging need in pediatric medical education for positive guidelines in making and responding to an ADHD diagnosis.[1]

Generally, pediatricians are very familiar with the process of screening in the course of their work with children and adolescents. However, most of the comfort level for such

screens remains at the biomedical level as opposed to the behavioral level. Although multiple behavioral screening instruments with adequate reliability and validity statistics exist, systematic evaluation for behavioral health issues is not common considering its importance to the child and family for overall health.[7]

Many ADHD evaluation instruments are available. However, few are designed to allow resident physicians to recognize common developmental presentations of ADHD, determine the need for additional assessment, and know what to do after an diagnosis has been made. Further, resident physicians often arrive at their respective residency programs ill equipped to deal with the demands of an ADHD assessment.

Special care needs to be given concerning extended assessment of ADHD. Resident physicians are expected to respond quickly and efficiently but may have little or no real experience with an ADHD child in their exam room. More intensive evaluation of ADHD typically involves behavior rating scales utilizing educational personnel. A diagnosis of ADHD may result in prescribed medicines. A pre-set screening instrument might well assist in that process.

This study presents the reliability and validity data for the Pediatric Residency Checklist/ADHD (PCR/ADHD), a brief screening instrument designed to assist pediatric resident physicians in diagnostic history-taking and decision-making with regard ADHD. In spite of numerous indices to determine the presence of ADHD,[8-10] no screening instrument which would direct a more detailed evaluation, designed specifically for pediatric residents, exists.

The Pediatric Residency Checklist/ ADHD (see Appendix A) contains a series of questions for pediatric residents to ask in conversation with both parents and children who present to pediatric clinics. It focuses awareness on specific behaviors required for diagnosis and prompts the resident physician to insure the behavior in question occurs across multiple settings, which is also a diagnostic requirement. In addition, the PRC/ADHD aids the resident in obtaining the necessary genetic history by providing a framework for taking a family genogram. Finally, the instrument allows residents to check on common presentations of children with ADHD across multiple age ranges. As such, it cues resident physicians to ask questions, which will shed light on specific behavioral questions required for a firm and meaningful diagnosis of ADHD. Also, common diagnoses to be ruled out are highlighted. Finally, the PRC/ADHD also contains standardized instructions for the administration of medical interventions should that be required.

In addition, the Pediatric Residency Comfort Questionnaire (PRCQ) (see Appendix B) was developed to survey resident comfort levels and understanding of the ADHD diagnostic process. It was developed as a pre- and post-test measuring device to determine the PRC/ADHD's value to residents. As such, this study assessed the value of the screening instrument by surveying residents before and after its introduction.

Methods

Each pediatric resident from first to fourth year was asked to complete the Pediatric Residency Comfort Questionnaire. Then, each resident was trained in the use of the Pediatric Residency Checklist/ADHD prior to its introduction into the residency program. The instruction included specific scoring, history taking, and the use of the interview in observation of the child in clinic.

The items of the PRC/ADHD were derived from DSM-IV[11] criteria for both inattention and hyperactivity/impulsivity. Positive scores were achieved when the item

was scored as "Very Often" and in "more than one setting". In addition, each resident was trained in steps occurring after the initial evaluation. These steps included additional assessment in more advanced and previously-validated assessment instruments as well as follow-up at the Pediatric Clinic. The additional assessment instruments included:

- The Conners' Continuous Performance Test II[12]
- The Conners' Teacher Rating Scale (CTRS-R)[13]
- The Conners' Parent Rating Scale (CPRS-R)[14]
- The Child Behavior Checklist (CBCL)[15]
- Teacher Rating Form (TRF)[15]
- The Attention Deficit Disorders Evaluation Scale-Home Version[16]
- The Attention Deficit Disorders Evaluation Scale-School Version[17]

All families with patients presenting at the Wesley Pediatric Clinic over a nine-month period with concerns regarding school-related behavioral problems were asked to be part of the study. Those agreeing (n = 63) were given each of the assessment instruments including the Pediatric Residency Checklist/ADHD. The combination of scores on all of these assessment instruments, plus clinical judgment, resulted in assignment of children to either the ADHD or Non-ADHD groups.

The Receiver Operating Characteristic (ROC) was utilized to assess the accuracy of the PRC/ADHD score in differentiating patients with and without the diagnosis of ADHD and to determine a cut-point for the PRC/ADHD score.[18] The PRC/ADHD cut-point score was incorporated into a logistic regression model with the binomial variable of ADHD diagnosis as the dependent variable.[19] In addition, the binomial variables, age and gender, were included as independent variables in the logistic regression model to control for possible confounding of results.

A sub-sample (n = 25) of the original respondents to the study was re-tested after six weeks with the PRC/ADHD for test/re-test reliability analysis using Pearson correlation coefficients.[20] Finally, scores on the Pediatric Residency Comfort Questionnaire were compared before and after introduction to pediatric residents and analyzed using t-test statistics.[20] All statistical analysis was performed using STATA version 8 software for Macintosh.[21]

Results

The Receiver Operating Characteristic (ROC) analysis is detailed in Table 1 and Figure 1 for the PRC/ADHD diagnosis. At a PRC/ADHD score of 10 or higher, 88.9% of patients were classified correctly as having ADHD or not having ADHD. The sensitivity for ADHD diagnosis was 94.4% and the specificity was 81.5%. The positive likelihood ratio using a PRC/ADHD cut-point score of 10 was 5.1. Patients with ADHD were 5.1 times more likely to have a PRC/ADHD score of 10 or higher as compared to patients without ADHD. Similarly, the negative likelihood ratio of 0.07 signified that subjects with ADHD were 0.07 times as likely to have a PRC/ADHD score less than 10 as compared to subjects without ADHD.

With the binary variable of ADHD diagnosis as the dependent variable (i.e., PRC/ADHD score of 10 or higher), a multivariate logistic regression model was constructed with gender, age, and PRC/ADHD score as independent variables. The odds of having a diagnosis of ADHD were 404 times the odds of not having

Table 1. Results of receiver operating curve analysis.

Cut Point	Sensitivity	Specificity	Correctly Classified
>=2	100.00%	0.00%	57.14%
>=4	97.22%	3.70%	57.14%
>=5	97.22%	14.81%	61.90%
>=6	97.22%	25.93%	66.67%
>=7	94.44%	37.04%	69.84%
>=8	94.44%	44.44%	73.02%
>=9	94.44%	66.67%	82.54%
>=10	94.44%	81.48%	88.89%
>=11	86.11%	85.19%	85.71%
>=12	75.00%	85.19%	79.37%
>=13	58.33%	85.19%	69.84%
>=14	36.11%	92.59%	60.32%
>=15	22.22%	100.00%	55.56%
>=16	16.67%	100.00%	52.38%
>=17	2.78%	100.00%	44.44%
>17	0.00%	100.00%	42.86%

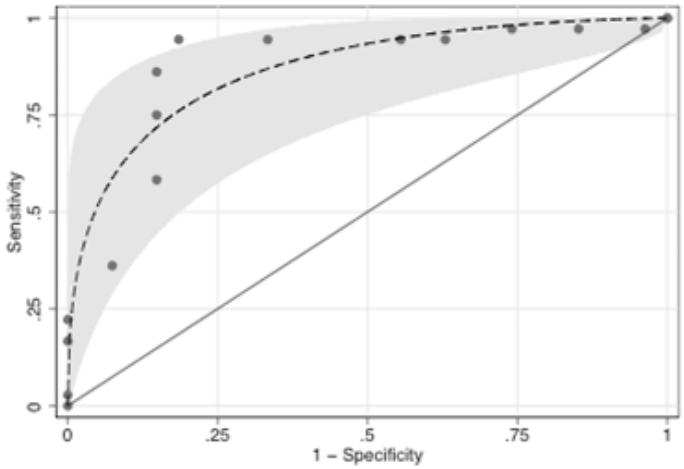

Figure 1. Fitted ROC curve with 95% confidence band for PRQ score and ADHD diagnosis.

statistically significant ADHD in those subjects with a PRC/ADHD score of 10 or higher while controlling for age and gender (95% CI 38-21388). Gender and age were not variables in the model (p values were 0.54 and 0.14 respectively).

Using Pearson product moment correlations (n = 25), the PRC/ADHD had six-week test-retest correlations of 0.89 (p < .0001) for Inattention, 0.91 (p < .0001) for Hyperactive/Impulsive, and 0.94 (p < >0001) for the combined total.

Comfort level scores before and after the introduction of the PRC/ADHD reflected that residents were more comfortable in their assessments and treatment of ADHD after

having had some instruction in the application and use of the Pediatric Resident Checklist/ADHD. Comfort level mean scores of the pre-test by all residents at each pediatric level were 28.5 while post-test comfort level means were 46.6 ($p < .001$).

Discussion

The results suggested the viability of the PRC/ADHD as a screening device for ADHD, especially in the day-to-day operations of a medical school pediatric clinic. The addition of the Pediatric Residency Checklist/ADHD benefitted residents in terms of increased comfort levels in the assessment and treatment of ADHD. However, this assessment device is only one in the growing arsenal of such instruments and possibly should be considered for use only in relation to medical residency programs as an educational as well as assessment tool. The PRC/ADHD offers a practical instrument for helping resident physicians offer the best care to this specific population of patients.

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Keywords: attention deficit hyperactivity disorder, medical residency, pediatrics, screening, diagnosis

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APPENDIX A

KUSM-W PEDIATRIC RESIDENCY CHECKLIST/ ADHD

Form completed by: ***Patient:***

Date:

Instructions: Make filling out the form a conversation. Include parent and child responses. "P" = parent response. "C" = child response. Score only "OFTEN TRUE" responses.

	FREQUENCY			SETTING			
	NOT TRUE	SOME-TIMES	OFTEN TRUE	HOME	SCHOOL	PEERS	SELF
1. INATTENTION (scoring: 6 out of 9=often true)							
a. Tends to make careless mistakes on schoolwork / household chores?							
b. Easily distracted in tasks and/or play activity?							
c. Adult needs to repeat himself or herself?							
d. Tends to quit a project prior to completion?							
e. Tends to have difficulty organizing prior to attempting task? (i.e. Schoolwork)							
f. Tends not to get involved with activities that require attention?							
g. Frequently misplaces things?							
h. Easily distracted when in the middle of something they enjoy?							
I. Forget important events / items?							
2. HYPERACTIVITY/IMPULSIVITY (scoring: 6 out of 9=often true)							
a. Tends to fidget in their seat?							
b. Tends to leave their seat without good reason?							
c. Tends to run from place to place?							
d. Not able to have a quiet time of appropriate time for age?							
e. Seem to be "on the go" at all times?							
f. Talk excessively?							
g. Blurt out phrases / answers inappropriately?							
h. Unable to play board games with other children?							
I. Interrupt other conversations?							

3. Age at onset _____?

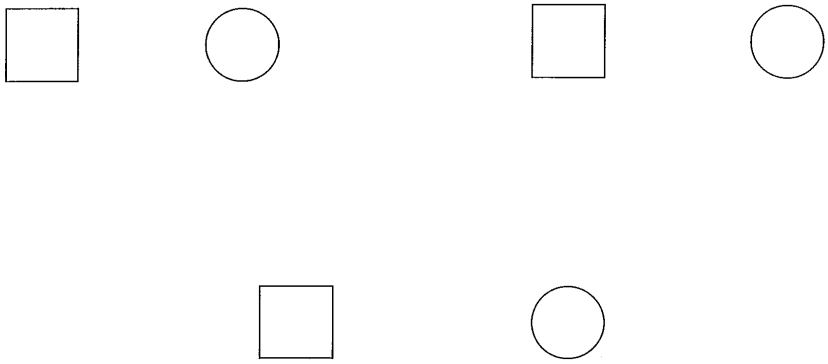
How long has this been a problem _____? (must be at least six months)

How severe _____ _____ _____ ?(must effect more than one setting)

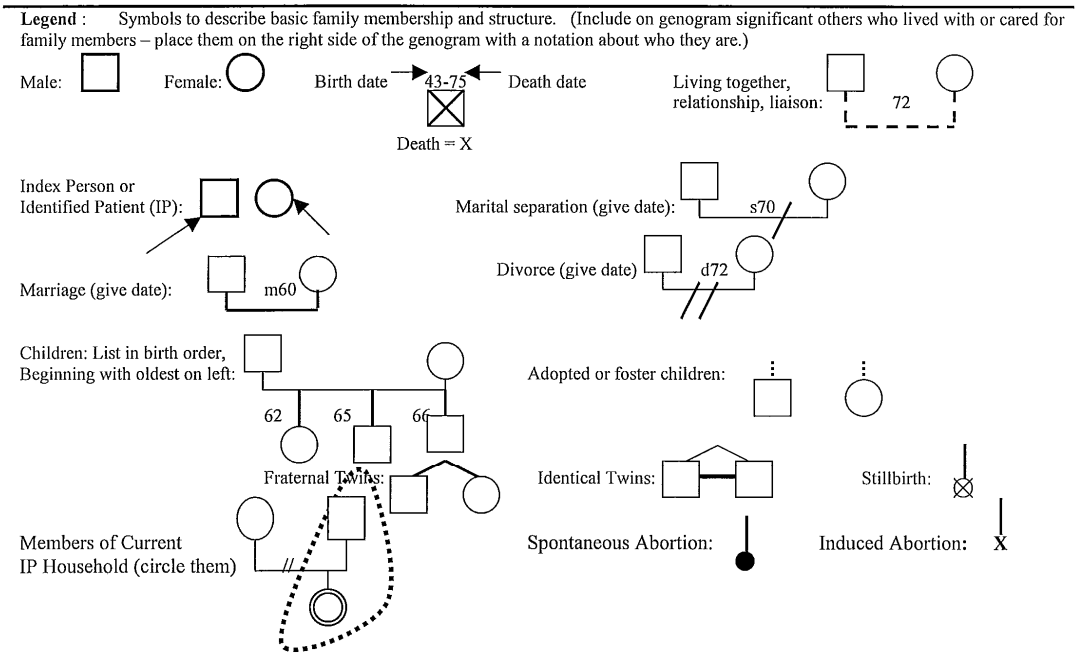
Affecting only 1 setting — Affecting 2 or more settings — Affecting everything

KUSM-W PEDIATRIC RESIDENCY / ADHD CHECKLIST

4. Genogram (Look for family history that may include ADHD, affective and anxiety disorders, learning disorders, conduct, oppositional and antisocial disorders, alcohol and substance abuse).



CHILD



KUSM-W PEDIATRIC RESIDENCY / ADHD CHECKLIST

Medical Notes:*

5. Rule out: Pervasive developmental disorder, hypoglycemia, anemia, diabetes, hyperthyroidism, sleep apnea, schizophrenia, anxiety disorder, depressive disorder, bipolar disorder, acute infections, seizure, hearing and/or vision problems, allergies, and genetic disorders.

6. Medical and developmental risk factors:
    a. Prenatal and post-natal difficulties
    b. Maternal substance abuse
    c. Poor maternal health
    d. Vitamin and mineral deficiencies
    e. Multiple ear infections
    f. Headaches
    g. Frequent illnesses
    h. Poor eye-hand coordination
    i. Accident prone

7. Characteristics:
    a. ADHD presentation in infancy:
        i. Crying frequently
        ii. Unable to soothe
        iii. Sleep disturbance
        iv. Feeding difficulties

    b. ADHD presentation in preschool age:
        i. Motor restlessness
        ii. Insatiable curiosity
        iii. Vigorous > destructive play
        iv. Demanding
        v. Non-compliance
        vi. Excessive temper tantrums
        vii. Difficulty completing developmental tasks
        viii. Decreased/restless sleep
        ix. Delays in motor/language development
        x. Family difficulties

    c. ADHD presentation in middle childhood:
        i. Distractibility
        ii. Over-engagement in off task activities
        iii. Inattentive
        iv. Lack of social skills
        v. Aggressive
        vi. "Class clown"
        vii. Problems with peers
        viii. Labeled "difficult" or "lazy"
        ix. Behavioral impulsivity
        x. Cognitive impulsivity

    d. ADHD presentation in adolescence
        i. Discipline problems
        ii. Family conflict
        iii. Emotional lability
        iv. Lags in academic performance
        v. Poor peer relationships
        vi. Poor self-esteem
        vii. Helplessness ("Given up" Syndrome)
        viii. Lack of motivation
        ix. Driving mishaps – accident prone

*Adapted from *Attention Deficit Hyperactivity Disorder (in Adults and Children)* by C. Keith Conners, PhD and Juliet L. Jett, PhD, Compact Clinicals, Kansas City, MO, 1999.

KUSM-W PEDIATRIC RESIDENCY / ADHD CHECKLIST

ADHD Med Check Instructions:

Once diagnosis of ADHD has been made, you may want to utilize one of the following strategies with reference to medical interventions involving medications:

1. Use Parent/Teacher questionnaires to assess the medicine's effectiveness(for example the ASQ-T and ASQ-P by Conners or the Pediatric Department's own Parent and Teacher evaluation forms which are located at the nurses station):
    a. Ten forms are given to each i.e. one set of 10 for parents and one set of 10 for the teacher.
    b. Parents and teachers fill out forms on a daily basis.
    c. On the third or fourth day, medicines are taken (teacher is "blind" to whether medicines are "on board").
    d. Evaluations are returned to the Pediatrician.
    e. The evaluations should reflect positive change. If not, a change in medicines and/or dosage may be indicated.

2. Alternative strategy:
    a. Ten forms are given to each i.e. one set of 10 for parents and one set of 10 for the teacher.
    b. Start child, first week, with the lowest dose of medicine and have both parents and teacher fill out forms randomly two days out of each week.
    c. For the next week, repeat with next highest dose.
    d. Repeat for total of four weeks.
    e. Assess results of both parent and teacher evaluations to determine best medication dosage or need for medication change and repeat a-b.

NOTES:

APPENDIX B

PEDIATRIC RESIDENCY COMFORT QUESTIONNAIRE

1. PGY level_____
2. Approximately how many ADHD assessments have you participated in prior to residency training?_____
3. Approximately how many ADHD assessments have you participated in since your residency experience began?_____
4. What evaluation instruments do you use?_____
   _____
   _____

Please use this scale on the following questions:

not at all						very
1	2	3	4	5	6	7

5. How comfortable are you with the evaluation instruments you use?_____
6. How comfortable are you with performing ADHD assessments generally?_____
7. How comfortable are you with your knowledge of DSMIV criteria for ADHD?__
8. Do you routinely take a family genogram when evaluating for ADHD?_____
9. How comfortable are you generating a family genogram in the assessment of ADHD?_____
10. How would you rate your understanding of common developmental presentations of ADHD?__
11. How comfortable do you feel in beginning evaluations for treatment (meds dosage etc.) of ADHD?_____
12. How would you rate your understanding of medical and developmental risk factors for ADHD?_____
13. How much understanding do you believe you have concerning disorders that must be ruled out before an ADHD diagnosis can be made?_____