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Evidence-Based Assessment in Clinical Settings: Reducing Assessment Burden for a Structured Measure of Child and Adolescent Anxiety

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Clinically useful and evidence-based mental health assessment requires the identification of strategies that maximize diagnostic accuracy, inform treatment planning, and make efficient use of clinician and patient time and resources. This study uses classification tree analyses to determine whether parent- and child-report instruments, alone or in combination, can accurately predict diagnoses as measured by the Anxiety Disorders Interview Schedule (ADIS). The ADIS, which is the gold-standard semistructured interview for anxiety disorders in children and adolescents, requires formal training and lengthy administration. Data were collected as part of the standard diagnostic assessment process for 201 patients (ages 5 to 17 years) in an urban outpatient psychiatry specialty clinic. Analyses examined 2 models to determine which predictors reached an acceptable level of diagnostic accuracy for generalized anxiety, social anxiety, and separation anxiety disorders. The first model used scores on a parent- and child-report anxiety measure combined with demographic factors, and the second model incorporated a broad-band measure of child psychopathology and a depression measure into the analysis. Although demographic factors did not emerge as accurate predictors in either model, particular measures, either alone or in combination, were able to predict specific ADIS diagnoses in some cases, allowing for the potential streamlining of ADIS administration. These results suggest that a classification-tree analysis lends itself to the construction of simple algorithms that have high clinical utility and may advance the feasibility and utility of evidence-based assessment strategies in real-world practice settings by balancing cost effectiveness, administration demands, and accuracy.

Keywords: implementation of measurement-based care, mental health assessment in hospital settings, innovative solutions to reduce assessment burden, predictors of anxiety diagnoses

Evidence-based practice in psychology seeks to "promote effective psychological practice and enhance public health by applying empirically supported principles of psychological assessment, case formulation, therapeutic relationship, and treatment" (APA Presidential Task Force on Evidence-Based Practice, 2006, p. 273). Although evidence-based treatment (EBT) has received most of the attention in the literature, research is needed to provide an evidence base for clinical assessment procedures, as well (Roberts, Blossom, Evans, Amaro, & Kanine, 2017). Appropriate intervention, patient engagement in treatment, and treatment outcomes are contingent upon accurate and comprehensive assessment (Jensen-Doss, 2015; Youngstrom & Van Meter, 2016), and psychologists may be uniquely qualified to contribute to the assessment process (Jensen-Doss, 2015; Mash & Hunsley, 2005; Youngstrom & Van Meter, 2016).

Research on evidence-based assessment (EBA) lags behind EBT research. Dissemination of EBA practices to community clinical settings has been limited (Ebesutani, Bernstein, Chorpita, & Weisz, 2012; Roberts et al., 2017), and a recent survey of community mental health practitioners found that fewer than 10% of providers frequently use structured interviews and rating scales (Whiteside, Sattler, Hathaway, & Douglas, 2016). The lag in EBA research is most notable in the lack of systematic study of the EBA process, that is, how to integrate data from multiple assessment methods and multiple informants (Roberts et al., 2017). Further research is needed to understand how best to integrate multiple methods of assessment to improve diagnostic accuracy, efficiency in making an informed diagnosis, or both, with resulting benefits in patient engagement and outcomes (Jensen-Doss & Weisz, 2008; Pogge et al., 2001).

Structured Interviews

Structured and semistructured diagnostic interview schedules can play an important role in the EBA of child and adolescent psychiatric disorders. Although the unstructured clinical interview

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is the most common method of assessment of child and adolescent psychopathology, it is prone to error, has poor interrater reliability, and has variance in use of diagnostic criteria (Rettew, Lynch, Achenbach, Dumenci, & Ivanova, 2009). Structured and semistructured diagnostic interviews are more reliable and valid than unstructured interviews, more precisely quantify psychological symptoms, and facilitate comprehensive assessment to avoid underdiagnosis or misdiagnosis (Nock, Holmberg, Photos, & Michel, 2007). Despite these advantages, structured and semistructured diagnostic interviews are not widely used in standard clinical practice because they are thought to be time-consuming for clinicians and patients, resource-heavy, costly (Ebesutani et al., 2012; Van Meter et al., 2014), and because many practitioners perceive them to be unhelpful or unnecessary (Whiteside et al., 2016).

Compared to semistructured and structured diagnostic interview schedules, both broad-band scales, for example, such as the Child Behavior Checklist/Youth Self-Report (Achenbach & Rescorla, 2001) and Child Symptom Inventory (CSI; Gadow & Sprafkin, 1994), and disorder-specific scales, for example, the Screen for Child Anxiety Related Disorders (SCARED; Birmaher et al., 1997), are less time consuming for staff to administer and for parents and children to complete (Blossom & Roberts, 2017; Ebesutani et al., 2012; Jensen-Doss, 2015). Although questionnaires are sensitive to general psychopathology, the overall correlation is not sufficiently high to predict specific diagnoses or to assume that they can simply substitute for a diagnostic interview (Ebesutani et al., 2010, 2012; Van Meter et al., 2014).

Integrative Approaches

To reduce burden while capitalizing on available EBA methods, researchers have begun examining the possibility of using questionnaire-based screening approaches to guide selective interview administration to determine diagnosis and need for treatment (Chorpita, Yim, & Tracey, 2002; Ebesutani et al., 2012). Using a Bayesian approach, Chorpita and Nakamura (2008) found that the results of self-report questionnaires could be used to reduce the administrative time of the Anxiety Disorders Interview Schedule (ADIS; Silverman & Albano, 1996). Youngstrom, Choukas-Bradley, Calhoun, and Jensen-Doss (2015) described a Bayesian statistical approach to EBA that improves the estimation of diagnosis based on available information. This approach to improving diagnostic accuracy begins with an estimate of the likelihood that a child meets criteria for a diagnosis based on the prevalence or "base rate" of the disorder (in Bayesian terms, this is the "prior probability"). Subsequently, information related to the results of a screening measure or presence of a risk factor is used to improve the estimate of the probability that a diagnosis is present (this is the "posterior probability"). Calculating the posterior probability uses a diagnostic likelihood ratio based on the prevalence of disorder associated with a risk factor or from the sensitivity and specificity of a given test. Online diagnostic likelihood ratio calculators (Lavigne, Feldman, & Meyers, 2016) and graphical nomograms (Youngstrom & van Meter, 2016) can be used to calculate the probability of a diagnosis. These techniques have been used to improve accuracy in estimating the probability of pediatric bipolar disorder, ADHD, PTSD, and anxiety diagnoses (Frazier & Youngstrom, 2006; Jenkins, Youngstrom, Washburn, & Youngstrom, 2011; Van Meter et al., 2016; You, Youngstrom, Feeny, Youngstrom, & Findling, 2017).

The use of Bayesian methods and nomograms/sequential nomograms represents an advance in empirically based assessment procedures. Nonetheless, their application in clinical child and adolescent psychology is still quite new, and there are certain limitations. First, their use is dependent upon knowledge of the base rate for the disorder in a particular setting. Base rates (i.e., the prior probability) may vary from a community setting to a general mental health clinic to a specialty clinic and may not be available in all situations (Jenkins et al., 2011). Second, the nomogram approach generates two sets of odds: the likelihood of the disorder being present if the individual's score exceeds the clinical cutoff for that measure (positive posterior probability) and the likelihood that the disorder is present if the individual's score is below the cutoff (negative posterior probability). Although both probabilities are potentially important in EBA, little attention has been paid to the use of negative posterior probabilities. Because of these limitations, other approaches to determining the need for structured interview administration should be examined. The purpose of this study was to evaluate such an alternative involving classification tree analysis (CTA).

Current EBA Methods to Assess Anxiety in Children and Adolescents

Efforts to identify efficient, accurate, evidence-based approaches to assessing anxiety in children and adolescents are particularly important because anxiety disorders are among the most prevalent psychiatric disorders for this age group (Degnan, Almas, & Fox, 2010). Anxiety disorders are often undiagnosed or misdiagnosed, because children with anxiety are not as easily recognized as children with disruptive behavior disorders (Tomb & Hunter, 2004) and because there is low concordance between parent and child report (Becker-Haimes, Jensen-Doss, Birmaher, Kendall, & Ginsburg, 2018; Muris, Meesters, & Spinder, 2003).

The ADIS for *DSM–IV*: Child & Parent Versions (ADIS-IV-C/P; Silverman & Albano, 1996; Silverman, Saavedra, & Pina, 2001), a semistructured diagnostic interview that assesses anxiety in children and adolescents, ages 6–17, is considered the gold standard when assessing for specific anxiety diagnoses, including generalized anxiety disorder (GAD), social anxiety disorder (SOC), and separation anxiety disorder (SEP), in randomized controlled trials (Silverman & Ollendick, 2005). Although anxiety disorders share similar underlying processes (e.g., apprehension, avoidance), they differ in terms of the content of apprehension and the resultant focus of cognitive–behavioral therapy, the treatment of choice for childhood anxiety disorders (Silverman & Ollendick, 2005). Effective treatment of pediatric anxiety relies on precise identification of specific types of anxiety disorders to ensure appropriate exposure tasks in therapy.

Current Study

The present study sought to advance the understanding of the EBA process in the diagnostic assessment of child anxiety disorders by using optimal data analysis (ODA; Yarnold & Soltysik, 2005) to determine the extent to which multi-informant brief assessments and demographic information can predict diagnoses

obtained through a semistructured clinical interview, the ADIS. ODA produces a classification tree (sometimes also described as a decision tree) that can be used to see how combinations of variables may be combined to predict an event's occurrence. In contrast to Bayesian approaches, ODA does not rely on knowing the local prevalence of the disorder and can integrate multiple predictors, including multi-informant assessments and patient characteristics. If the use of empirically supported scales, either alone or combined with other predictors (e.g., patient demographics), predicts ADIS anxiety diagnoses reasonably well, then clinicians can remain true to the principal of engaging in EBA while reducing the time and cost burden of ADIS administration for patients and themselves.

We compared how closely the classification trees predicted an ADIS diagnosis compared to the percent agreement between raters on the ADIS itself reported in previous studies (Lyneham & Rapee, 2005; Lyneham, Abbott, & Rapee, 2007). The analytical approach taken herein is a form of statistical learning (Youngstrom, Halverson, Youngstrom, Lindhiem, & Findling, 2018) that depends on computer technology to consider repeated iterations of all combinations of variables to find the best model, instead of a priori hypotheses about the best predictors. We predicted that, for some diagnostic categories, agreement would be sufficiently high that administration of the ADIS might not be necessary. For others, agreement would be sufficiently low that administration of the ADIS (or portions of the ADIS) would be warranted to obtain an accurate diagnosis.

Method

Sample

The sample included 201 children referred to a multidisciplinary anxiety specialty clinic (staffed by psychiatrists, psychologists, and social workers) in an urban academic medical center between November 2007 and June 2016. Most patients are self-referred to this clinic, but some are referred from the intensive psychiatric or medical services at the medical center or outside community health care providers. Children seen in this clinic have a primary mood or anxiety issue. Children with comorbid autism spectrum disorder or intellectual disability are referred to another clinic where clinicians provide comprehensive treatment for the primary neurodevelopmental disorder. Children who have a primary diagnosis of posttraumatic stress disorder or a disruptive behavior, impulse control, or conduct disorder are referred to another specialty clinic within the same department. Children from the anxiety specialty clinic were included in the sample if they had complete data from the measures (described below) used as standard practice in the clinic and if they met criteria for an anxiety diagnosis. Comorbid mood disorders were not exclusionary. The only exclusion criterion was missing data from one or more of the measures described below. Children in the study sample were between 5 and 17 years old (M = 11.44 years; SD = 3.03), including 90 (44.8%) boys, and parents classified their child's race/ethnicity as follows: 87 (43.3%) Latino/a, 72 (35.8%) White, 12 (6.0%) African American, six (3.0%) Asian, 15 (7.5%) mixed race, three (1.5%) Other; six (3.0%) provided no information. Insurance coverage for 110 (53.9%) children was through Medicaid.

Diagnoses for each child were determined using the ADIS. Sample sizes allowed for analysis of three types of anxiety disorders: GAD (n = 118, 59.9%), SOC (n = 123, 62.8%), and SEP (n = 60, 30.5%). Comorbidity among these three disorders was high (48.2%). Overall, 171 (85.1%) children received at least one of these diagnoses.

Measures

Demographics (Family Background Questionnaire). Parents provided information concerning the child's age, sex, and race/ethnicity. Information on insurance coverage was obtained from the medical record to serve as a proxy for socioeconomic status (e.g., children with Medicaid were considered to be of lower socioeconomic status).

ADIS-IV-C/P. The ADIS-IV-C/P (Silverman & Albano, 1996; Silverman et al., 2001) are semistructured diagnostic interviews used to assess psychopathology among youth ages 6–18, with a particular emphasis on anxiety disorders. Clinical severity ratings ranging from 0 to 8 are assigned by the clinician for each diagnosis with the ADIS-IV-C/P, with a clinical severity rating of 4 or greater representing symptoms and distress/interference at a level that meets full diagnostic criteria. There is strong evidence supporting the reliability, validity, and sensitivity to clinical change for the ADIS-IV-C/P (Silverman & Ollendick, 2005). Test–retest reliability for anxiety disorder diagnoses for both parent and child reports is excellent (κ coefficients, .80 to .92; Silverman et al., 2001), and interrater agreement for anxiety disorders diagnosed with the ADIS-IV-C/P is strong (κ coefficients, .80 to 1.0; Lyneham et al., 2007).

CSI and Adolescent Symptom Inventory-4. To assess child internalizing problems, parents of children ages 6–11 completed the Child Symptom Inventory-4 (CSI) while parents of youth ages 12–17 completed the adolescent version, the Adolescent Symptom Inventory-4 (ASI). Subscales used in the present study include generalized anxiety, separation anxiety, social phobia, specific phobia, obsessive symptoms, compulsive symptoms, and major depression scales. Coefficient alphas (α = .70–0.80), as well as convergent, divergent and discriminant validity, are high (Sprafkin, Gadow, Salisbury, Schneider, & Loney, 2002).

SCARED. The SCARED (Birmaher et al., 1997) is a 41-item questionnaire designed to assess a variety of anxiety symptoms occurring over the prior 3 months, with parallel parent- and child-report versions. The SCARED allows for calculation of a total anxiety score (0–82) and has a five-factor structure, with subscale scores for panic/somatic anxiety, generalized anxiety, separation anxiety, social phobia, and school avoidance. The SCARED has demonstrated discriminant validity between anxious and nonanxious youth, strong internal consistency (coefficient α of approximately .90), and favorable psychometrics in treatment-seeking samples (Birmaher et al., 1997; Monga et al., 2000; Muris & Steerneman, 2001; Rappaport, Pagliaccio, Pine, Klein, & Jarcho, 2017; Youngstrom & Van Meter, 2016).

Beck Depression Inventory-II and Beck Depression Inventory-Youth. Because mood disorders in outpatient settings have been found to generate false elevations on anxiety measures (Van Meter et al., 2016), Beck Depression Inventory-II measures were included in the CTAs. The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item

self-report measure of depressive symptoms that corresponds with the diagnostic criteria for major depressive disorder for individuals who are at least 13 years of age. Items are rated from 0 (low severity) to 3 (high severity) of symptoms over the past 2 weeks and are summed to provide a total raw score of depression severity ($\alpha = .91$; Erford, Johnson, & Bardoshi, 2016). The Beck Depression Inventory-Youth (BDI-Y; Beck, Beck, & Jolly, 2001) is a 20-item self-report questionnaire intended for use with children between ages 7 and 14 years, in this study, the BDI-Y was used with youth age 7 to 12 years of age. Respondents rate each item on a 4-point scale, ranging from 1 (*never*) to 4 (*always*), indicating how often the statement applies to them. *T* scores are calculated based on the sum of the raw scores and the child's gender and age. The BDI-Y has been found to have high convergent validity with other measures of child depression symptoms and coefficient is high ($\alpha = .94$; Steer, Kumar, Beck, & Beck, 2005). In this study, scores on the two BDI scales were dichotomized as moderate to high symptoms of depression versus low (normal—borderline/mild) symptoms of depression because of differences in scoring (raw vs. *T* scores, but both have cutoff scores for normal-borderline/mild and moderate to severe ranges).

Procedures

Study procedures were approved by the study site's Institutional Review Board. Parents and children completed questionnaires as part of their diagnostic intake battery. These took participants approximately 15 min to complete. ADIS anxiety modules were administered by staff clinicians and trainees as part of each child's diagnostic evaluation. All staff and trainees (child psychiatry fellows, psychology interns and practicum students, and social work interns) participated in a training on ADIS administration and practiced coding video-taped administration of the ADIS to establish reliability. Although interrater reliability was not tracked, clinicians participated in biweekly meetings in which trainees presented ADIS findings for new diagnostic evaluations, and all clinicians provided their estimate of the Clinical Severity Rating to establish a consensus rating. For the sake of efficiency, the clinician administered the ADIS-IV-C/P modules with the child or adolescent and at least one parent/guardian together (unless it was not possible because of the presence of selective mutism, language or communication barriers, or significant parent/child conflict; $n = 38$, 19% of the sample). ADIS administration took on average two 60-min sessions to complete. Data were obtained via chart review.

Statistical Analysis

Univariate optimal data analysis (Yarnold & Soltysik, 2005) is a statistical procedure that identifies optimal cutoff scores to predict a dichotomized "class" (e.g., presence or absence of a diagnosis) from continuous (e.g., questionnaires), dichotomous (e.g., sex), or categorical (e.g., race/ethnicity) variables. The analytic procedure uses exact permutation probabilities requiring no distributional assumptions. Initially, each predictor variable (demographics, parent CSI/ASI, SCARED, and BDI scaled scores) is analyzed individually ("uni-ODA" analyses) to determine if there is a statistically significant cutoff score predicting the presence versus absence of the class variable (i.e., each ADIS diagnosis). If a significant cutoff score is identified, its stability as a predictor is assessed using a leave-one-out (LOO) procedure in which observations are removed one at a time from the sample, and the uni-ODA analysis is then repeated. Only cutoff scores that are both statistically significant and stable in LOO analyses are considered valid. For each uni-ODA, an effect size for sensitivity (ESS) is reported. The ESS summarizes the overall accuracy of each predictor, with ESSs ranging from 0% (chance effect) to 100% (perfect classification accuracy). ESS values are considered: $<$ 25%, weak; 25–49%, moderate; 50–74%, relatively strong; 75–90%, strong; $>$ 90%, very strong (Yarnold & Soltysik, 2005). Because a large number of comparisons were made for the uni-ODAs, consideration needed to be given to correcting for those multiple comparisons. To correct for multiple comparisons a Bonferroni-like, sequentially rejective Sidak procedure was used (Yarnold & Soltysik, 2005). Results were only considered to be valid if they were both statistically significant in the Sidak procedure and stable in LOO. At the next step, classification tree analyses (CTA) were conducted using an automated version of the ODA software (Soltysik & Yarnold, 2010) to identify the combination of variables maximizing classification accuracy in predicting ADIS diagnoses. All possible combinations of study variables included in the CTA are tested across the first three levels of analyses, and the best combination of all variables is identified. Subsequently, the tree is automatically "pruned" using a sequentially rejective Bonferroni-type adjustment (Yarnold & Soltysik, 2005). Variables and subbranches not improving the overall ESS are eliminated to avoid overfitting (Yarnold & Soltysik, 2010). The minimum sample size at each endpoint in the CTA model was set at 20.

Two different models were examined for each ADIS diagnosis of GAD, SOC, and SEP. Because the SCARED is a widely used instrument for assessing anxiety, we sought to determine whether it was a useful predictor of the ADIS diagnoses along with demographic factors, but without inclusion of other scales that might add a time and cost burden (Model 1). In Model 2, all predictors (demographics, parent CSI/ASI, SCARED, and BDI scaled scores) were entered.

Benchmarks for adequacy of prediction. Because some measurement error in screening measures is inevitable, and the reliability of the ADIS, although good, is less than perfect, expecting 100% accuracy in CTAs is unrealistic. For this reason, more realistic benchmarks for determining the acceptability of the accuracy of prediction with uni-ODAs and CTAs were sought. For screening measures, sensitivity and specificity of .80 is considered an acceptable level (Straus, Glasziou, Richardson, & Haynes, 2018), and we adopted a classification accuracy of 80% as a reasonable benchmark for a subgroup along each path.

In addition, because the interrater reliability of the ADIS is considered good, we compared the classification accuracy for each path with the interrater agreement for each ADIS anxiety diagnoses. To assess interrater agreement, we converted the kappa values from two studies to the percent agreement between raters. The calculated percent agreement with Lyneham and Rapee (2005; GAD, 92.16%; SOC, 95.42%; SEP, 98.04%) and Lyneham et al. (2007; GAD, 90.41%; SOC, 91.78%; SEP, 94.52%) would indicate high interrater agreement.

Results

Preliminary Analyses: Uni-ODAs

Table 1 presents the statistical significance, LOO stability, ESS, cutoff score and direction of effect for each variable as predictors of GAD, SOC, and SEP, respectively. Figure 6 contains clinical guidelines that clinicians can use as a reference as to whether further assessment with the ADIS may be warranted.

GAD. For GAD (see Table 1), the results were statistically significant, stable and moderate in ESS for the parent-report GAD scale; the child-report SCARED total anxiety, GAD, and school avoidance scales; and the parent CSI GAD and obsessive symptom scales. ESSs were statistically significant, stable, but weak for the child SCARED SEP scale.

SOC. For social anxiety (see Table 1), the results were statistically significant, stable, and moderate in ESS for the parent SCARED SOC scale, the child SCARED total anxiety and SOC scales, and the CSI social phobia scale. There was also a weak but significant association between receiving Medicaid benefits and SOC.

SEP. For separation anxiety (see Table 1), the results were statistically significant, stable and moderate in ESS for parent SCARED total anxiety, panic, and GAD scales; the child SCARED total anxiety, SEP, and school avoidance scales; the CSI SEP scale; and age, with children over age 11 more likely to be diagnosed with SEP. Results were statistically significant, stable, but weak in ESS for the child SCARED panic scale. Results were statistically significant, stable and relatively strong for parent SCARED SEP scale.

CTA

GAD. In Model 1 (ESS = 42.78%, moderate, Figure 1), only the child SCARED GAD scale emerged as a predictor of ADIS GAD diagnosis. Although the ESS indicates this is a moderately good predictive model overall, the predictive accuracy of the two arms is quite different. Specifically, a child SCARED GAD score >8 accurately predicted the presence of an ADIS GAD diagnosis 80.43% of the time. This is slightly lower than the interrater reliability of the ADIS itself but exceeds the 80% benchmark for accuracy adopted for this study based on the widely used standard of acceptability of screening measures and the interrater agreement for the ADIS. Given the added burden of administering the ADIS, reliance on the child SCARED GAD subscale alone when the score is >8 without administering the GAD sections of the ADIS may be warranted. However, a score of ≤8, accurately predicted the absence of an ADIS GAD diagnosis in only 60.26% of the cases, falling far short of the 80% benchmark. Thus, for child SCARED GAD subscale scores ≤8, administering the ADIS GAD section is appropriate.

Model 2 for GAD combines scores from the parent CSI GAD score and child SCARED GAD subscale score to predict ADIS GAD diagnosis. Model 2 emerged as superior to Model 1 in identifying children and adolescents unlikely to be assigned an ADIS GAD diagnosis (Model 2 ESS = 50.99%, relatively strong; Figure 2). When the CSI GAD scale *T* score was >69, the presence of the ADIS GAD diagnosis was predicted correctly 81.25% of the time, a rate slightly higher but comparable to the child SCARED in Model 1. This exceeds the benchmark and suggests that the administration of the ADIS GAD section is not needed if the parent CSI GAD score exceeds that cutoff. When the CSI GAD scale was ≤69 and the child SCARED GAD scale was >7, the presence of an ADIS GAD diagnosis was predicted correctly 70.37% of the time. Thus, administration of the ADIS GAD section to children in that category is advisable. When the CSI GAD scale was below 69 and the child SCARED GAD was ≤7, the absence of an ADIS GAD diagnosis was correctly predicted 85.71% of the time. This exceeds the benchmark scores and is only slightly lower than the interrater agreement for the ADIS GAD scale, suggesting that administration of the ADIS GAD section is not needed if the child's scores fall below those two measures. Thus, the Model 2 tree met the higher 80% benchmark for two of the three branches. However, if a child scored 69 or below on the CSI and above 7 on the child SCARED GAD scale, then administration of the ADIS GAD section is likely warranted.

SOC. For social anxiety, there was no difference in ESS for Models 1 and 2. In Model 1 (ESS = 54.26%, relatively strong; Figure 3), a child SCARED SOC score >7 predicted an ADIS SOC diagnosis 88.0% of the time. This exceeds the benchmark and approaches the interrater reliability of the ADIS, indicating it may be unnecessary to administer the SOC section of the ADIS for patients whose scores exceed the cutoff. A combined child SCARED SOC score ≤7 and a parent SCARED SOC score ≤6 correctly predicted the absence of an ADIS SOC diagnosis 72.88% of the time, whereas a child SCARED SOC score ≤7 combined with a parent SCARED SOC score >6 correctly predicted an ADIS SOC diagnosis 70.59% of the time. These scores do not reach the 80% benchmark, so administering the ADIS SOC section if the child SCARED SOC scale ≤ is 7 will improve accuracy and is likely to be useful.

Model 2 (see Figure 4) included different scales (child SCARED total score; CSI SOC), but the ESS was nearly equivalent (ESS = 54.64%, relatively strong). A child SCARED total anxiety score >40 correctly predicted an ADIS SOC diagnosis 86.76% of the time. A child SCARED total anxiety score ≤40 combined with a CSI SOC raw item score >1 correctly predicted an ADIS SOC diagnosis 78.00% of the time. A child SCARED score ≤40 combined with a CSI SOC raw item score ≤1 correctly predicted the absence of an ADIS SOC diagnosis 76.74% of the time. Thus, for Model 2 when predicting a diagnosis of SOC, one branch exceeded the 80% benchmark, indicating that administration of an ADIS may be unnecessary if child SCARED total anxiety score is >40; however, if the score is ≤40, ADIS administration is warranted.

SEP. In Model 1 (ESS = 62.57, relatively strong; Figure 5), the parent SCARED SEP scale emerged as a significant predictor of the ADIS SEP diagnosis. However, that scale was not stable in LOO. The results were similar for Model 2 (not depicted); only the parent SCARED SEP scale was significant, but not stable in LOO in the CTA.

As a result, the best predictor was the parent SCARED separation anxiety score when entered as a sole predictor in the uni-ODA, which was statistically significant ($p = .0004$) and stable ($p = .0001$) with a relatively strong ESS of 62.57%. A score of >5, however, only predicted an ADIS SEP diagnosis correctly 61.1% of the time, a level far below the 80% benchmark. Thus, administering the ADIS SEP section is likely to be useful when the parent SCARED SEP scale score is >5. A score of ≤5 on this scale correctly predicted the absence of an ADIS SEP diagnosis 92.5% of the time, a level of prediction exceeding both benchmarks and indicating that administration of the ADIS may not be necessary in these cases.

Table 1
Univariate Optimal Data Analysis (Uni-ODAs)

	Generalized anxiety disorder				Social anxiety disorder				Separation anxiety disorder			
Predictor variable	Significance (LOO significance)	Effect strength	Direction−	Direction+	Significance level	Effect strength	Direction−	Direction+	Significance level	Effect strength	Direction−	Direction+
Age	*ns*				*ns*				.0014 (.0004)	27.25%	If ≤ 11, predict 0	If > 11, predict 1
Sex	*ns*				*ns*				ns			
Race	*ns*				*ns*				ns			
Medicaid	*ns*				.019[a] (.01)	17.95%	If not IDPA, predict 0	If IDPA, predict 1	ns			
BDI category	*ns*				*ns*				ns			
Parent SCARED total anxiety	.004[a] (.0006)	25.57%	If ≤ 25, predict 0	If > 25, predict 1	.01[a] (.0017)	23.56%	If ≤ 31, predict 0	If > 31, predict 1	.0001 (.0001)	35.83%	If ≤ 38, predict 0	If > 38, predict 1
Parent SCARED panic	*ns*				.03[a] (.007)	19.81%	If < 2, predict 0	if > 2, predict 1	.0024 (.0006)	27.41%	If ≤3, predict 0	If > 3, predict 1
Parent SCARED GAD	.0004 (.0004)	28.93%	If ≤6, predict 0	If > 6, predict 1	*ns*				.0038 (.0346)	25.74%	If ≤7, predict 0	If > 7, predict 1
Parent SCARED separation	*ns*				*ns*				.0004 (.0001)	62.57%	If ≤5, predict 0	If > 5, predict 1
Scared Parent social	*ns*				.0001 (.0001)	47.91%	If < 6, predict 0	If > 6, predict 1	.02[a] (.003)	21.84%	If ≤ 10, predict 0	If > 10, predict 1
Parent SCARED school avoidance	*ns*				*ns*				.001 (*ns*)			
Child SCARED total anxiety	.0004 (.0006)	32.60%	If ≤ 27, predict 0	If > 27, predict 1	.0036 (.0001)	26.79%	If ≤ 40, predict 0	If > 40, predict 1	.0001 (.0001)	40.90%	If ≤ 33, predict 0	If > 33, predict 1
Child SCARED panic	.046[a] (*ns*)				*ns*				.003 (.013)	18.89%	If ≤ 8, predict 0	If > 8, predict 1
Child SCARED GAD	.0001 (.0001)	42.78%	If ≤8, predict 0	If > 8, predict 1	*ns* (.06)				.007[a] (.0152)	19.36%	If ≤ 7, predict 0	If > 7, predict 1
Child SCARED separation	.0006 (.0013)	23.23%	if ≤5, predict 0	If > 5, predict 1	*ns*				.0001 (.0001)	41.19%	If ≤ 4, predict 0	If > 4, predict 1
Child SCARED social	.043[a] (.035)	15.31%	If ≤7, predict 0	If > 7, predict 1	.0001 (.0001)	47.17%	If ≤7, predict 0	If > 7, predict 1	*ns*			
Child SCARED school avoidance	.0001 (.0003)	28.06%	If ≤2, predict 0	If > 2, predict 1	ns				.0032 (.0063)	26.00%	If ≤ 4, predict 0	If > 4, predict 1
Parent CSI GAD	0	46.84%	If ≤ 69, predict 0	If > 69, predict 1	ns				*ns*			
Parent CSI Separation anxiety	*ns*				ns				.0001 (.0001)	46.57%	If ≤ 63, predict 0	If > 63, predict 1
Parent CSI social phobia	*ns*				.0001 (.0001)	45.79%	If ≤ 1, predict 0	if > 1, predict 1	*ns*			
Parent CSI specific phobia	*ns*				ns				.005[a] (.0002)	26.19%	If ≤ 1, predict 0	If > 1, predict 1
Parent CSI obsessive disorder	.0002 (.0001)	31.25%	If = 0, predict 0	If > 0, predict 1	ns				.01[a] (.0047)	23.78%	If ≤ 1, predict 0	If > 1, predict 1
Parent CSI compulsive disorder	*ns*				.04[a] (.026)	16.83%	If = 0, predict 0	If > 0, predict 1	*ns*			
Parent CSI major depressive disorder	*ns*				.015[a] (.002)	24.08%	If ≤ 73, predict 0	If > 73, predict 1	*ns*			

Note. CSI = Child Symptom Inventory; SCARED = Screen for Child Anxiety Related Emotional Disorders; GAD = Generalized Anxiety Disorder; BDI category = Beck Depression Inventory categories (within normal limits-mild vs. moderate to high). Scales labelled *ns* are $p > .05$. With a correction factor for multiple comparisons, only scales for with $p < .009$ that are stable in leave-one-out (LOO) procedures are considered statistically significant.
[a] Not statistically significant (*ns*) in sequentially rejective Sidak procedure.

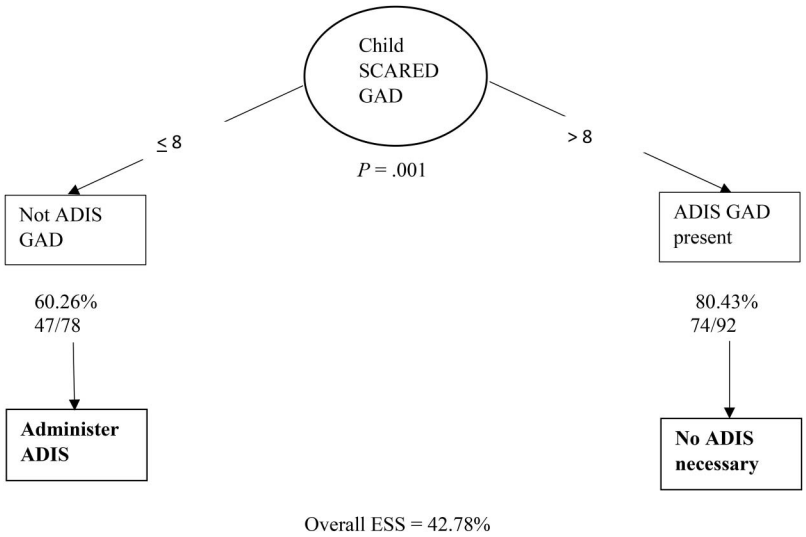

Figure 1. Predicting ADIS GAD diagnosis (present vs. absent) from SCARED parent and child scales (Model 1). ADIS = Anxiety Disorders Interview Schedule for *DSM-IV*; SCARED = Screen for Child Anxiety Related Emotional Disorders; GAD = generalized anxiety disorder; ESS = effect size for sensitivity.

Discussion

The purpose of this study was to determine whether questionnaires administered to youth and/or parents in a child anxiety clinic predicted specific anxiety diagnoses well enough to justify omission and/or selective administration of ADIS sections thereby reducing the time and resource burdens on clinicians and patients. With the advent of empirically supported therapies to treat particular disorders in child and adolescent mental health, specificity of diagnosis becomes especially important because it directly guides disorder-specific treatment. Despite the large literature which now exists in EBTs, less research is available on EBA approaches and on how to improve the feasibility and utility of EBAs in real world clinical settings. In an attempt to close this gap, this study relied on data collected in a specialty clinic in which the ADIS was administered along with self- and parent-report measures. Classification trees were used to determine whether the information gathered

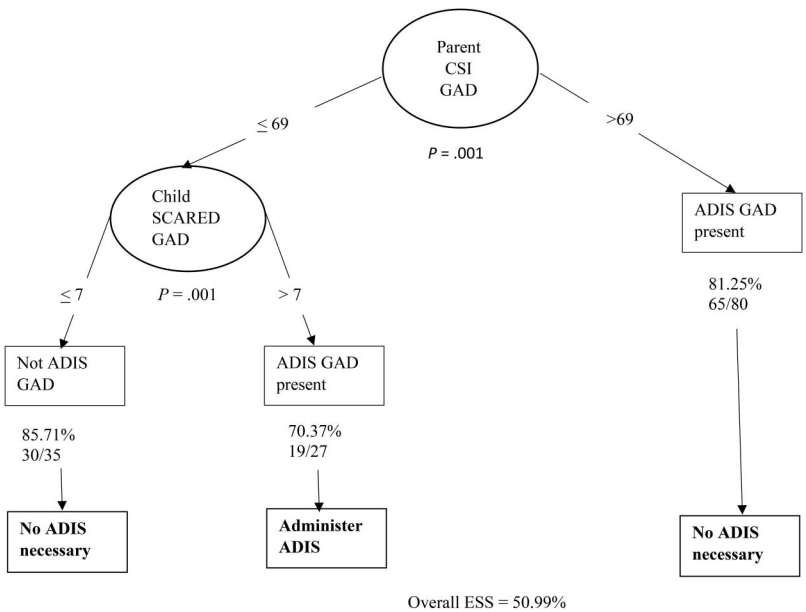

Figure 2. Predicting ADIS GAD diagnosis (present vs. absent) from SCARED parent and child scales, CSI, and BDI (Model 2); ADIS = Anxiety Disorders Interview Schedule for *DSM-IV*; SCARED = Screen for Child Anxiety Related Emotional Disorders; CSI = Child Symptom Inventory-4; BDI = Beck Depression Inventory; GAD = generalized anxiety disorder; ESS = effect size for sensitivity.

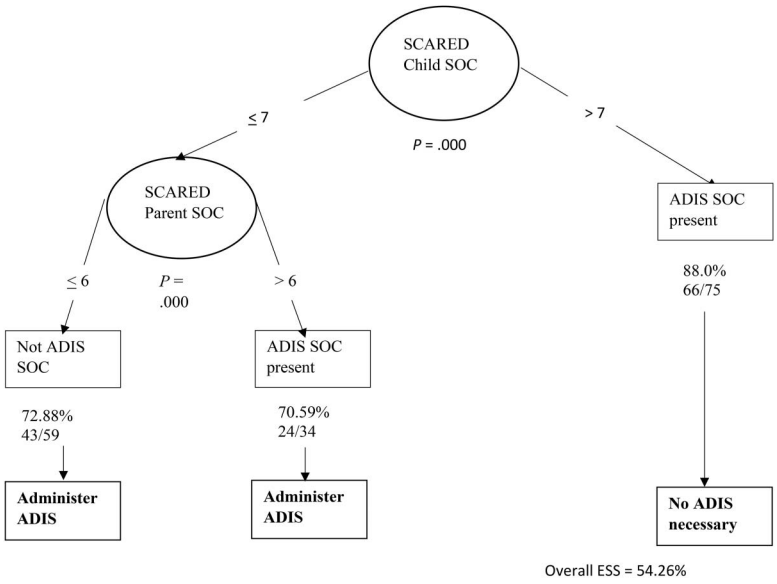

Figure 3. Predicting ADIS Social Anxiety diagnosis (present vs. absent) from SCARED parent and child scales (Model 1). ADIS = Anxiety Disorders Interview Schedule for *DSM-IV*; SCARED = Screen for Child Anxiety Related Emotional Disorders; SOC = social anxiety disorder; ESS = effect size for sensitivity.

from the less costly and time-consuming self- and parent-report measures corresponded to diagnoses of GAD, SOC, and SEP well enough to obviate the need to administer the ADIS, an EBA tool considered the gold standard for assessing anxiety.

Results of this study support the hypothesis that in many cases, reliance on self-report measures alone may be worth the reduction in time and clinician/patient burden that accompanies the use of the ADIS. For GAD, SOC, and SEP, ODA classification trees

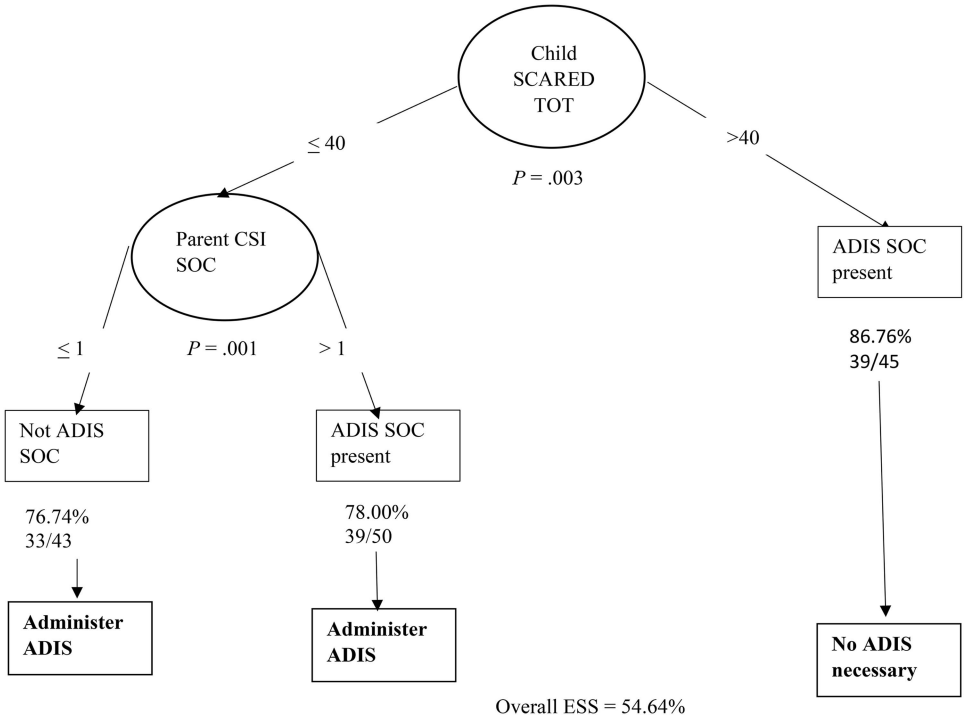

Figure 4. Predicting ADIS Social anxiety diagnosis (present vs. absent) from SCARED parent and child scales, CSI scales, and BDI (Model 2). ADIS = Anxiety Disorders Interview Schedule for *DSM-IV*; SCARED = Screen for Child Anxiety Related Emotional Disorders; CSI = Child Symptom Inventory-4; BDI = Beck Depression Inventory; SOC = social anxiety disorder; TOT = total anxiety; ESS = effect size for sensitivity.

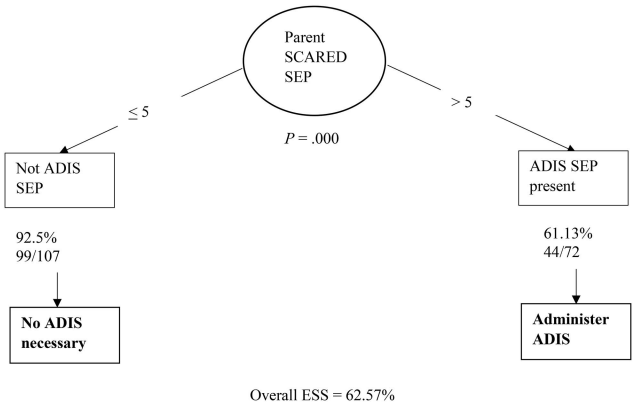

Figure 5. Predicting ADIS separation anxiety diagnosis (present versus absent) from SCARED parent scale (Model 1). ADIS = Anxiety Disorders Interview Schedule for *DSM-IV*; SCARED = Screen for Child Anxiety Related Emotional Disorders; SEP = separation anxiety disorder; ESS = effect size for sensitivity.

identified acceptable cut-off scores on one or more self- report and/or parent measures that allowed for decision rules that would, in some cases "rule in" or "rule out" diagnoses, thus eliminating the need for ADIS administration. For GAD, the parent CSI scale alone (with a cut-off of >69) accurately predicted ADIS GAD scores well enough to eliminate the administration of the ADIS. The parent CSI in combination with the child SCARED GAD subscale (cut-offs of ≤69 and ≤7, respectively) accurately predicted absence of a GAD diagnosis, eliminating the need for the ADIS administration. In contrast, a cut-off score on the child SCARED GAD subscale alone was not enough to eliminate the need for an ADIS administration. Thus, based on this study, for GAD, SOC, and SEP, certain identifiable combinations of self-report and parent questionnaires, either alone or in combination, likely provide enough information to render an accurate diagnosis in shorter amounts of time than is currently necessary for administration of gold standard semistructured interview instruments such as the ADIS. In a real world, fast paced clinical setting this information is invaluable as it can significantly streamline anxiety assessments while still maintaining fidelity to EBA. Interestingly, although the literature suggests that age (Li & Lopez, 2005), sex (McLean, Asnaani, Litz, & Hofmann, 2011) and social class (McLaughlin, Costello, Leblanc, Sampson, & Kessler, 2012) are associated with anxiety in community samples, and certain demographic findings were significant in uni-ODA (Medicaid status and social anxiety; age and separation anxiety); none of the demographic variables (including race/ethnicity, gender, age, or SES status) had a stronger association with one of the three diagnoses than did the SCARED and CSI sales. For that reason, none of the demographic factors were included in the CTAs.

Clinical Implications and Future Directions

As noted above, these study findings have direct implications for clinical practice. Just as the field has increasingly endorsed EBT in an effort to find valid, reliable, and efficient means for treating mental health disorders, there is a need for a similar exploration of EBA practices to improve the efficiency of diagnostic assessment procedures without sacrificing validity and reliability standards. The CTA analytic technique used in this study was effective in identifying specific cut-off scores on specific measures that allow clinicians to decide when they need to do the more extensive ADIS evaluation and when they have enough information based on self- and parent-report to predict with acceptable sensitivity and specificity a diagnosis that matches the diagnosis obtained from ADIS administration. Prior studies that have engaged in efforts to find evidence-based alternatives to administering lengthy structured interviews have used diagnostic likelihood ratios and nomograms. The present study suggests that the use of CTAs may improve upon that approach. CTAs offer several advantages over the use of nomograms. Unlike CTAs, nomograms require knowledge of the base rates of disorders in particular settings as well as an understanding of how to integrate multiple measures and individual variables. In contrast the process of using combinations of variables, including those from multi-informant instruments, to maximize predictive ability is straightforward in ODA. Additional research is needed to examine the

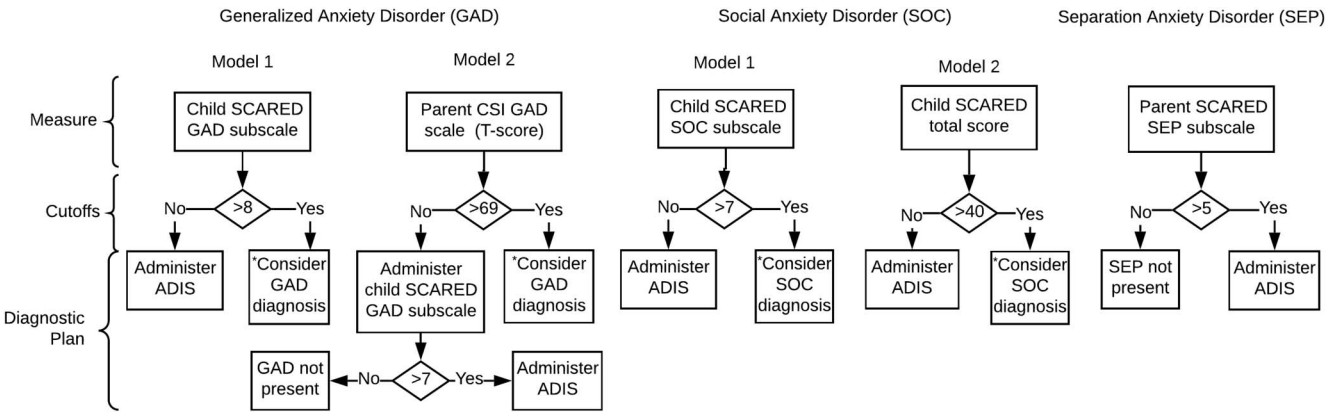

Figure 6. Clinical guidelines. ADIS = Anxiety Disorder Interview Schedule for *DSM-IV*; SCARED = Screen for Child Anxiety Related Emotional Disorders; CSI = Child Symptom Inventory; GAD = generalized anxiety disorder, SOC = social anxiety disorder; SEP = separation anxiety disorder. *Diagnosis should be considered. Clinical interview and context are required to confirm.

relative strengths of these two approaches in reducing assessment burden associated with structured interviews.

A strength of this study is the incorporation of parent and child versions of the same instruments for which the ODA weighed the contributions of specific scales by both reporters and determined which and whose responses best predicted an ADIS diagnosis. ODA may contribute to the literature on parent–child differences in symptom reporting by measuring specific differential strengths of a range of scales and items without a priori judgments about which reporter to favor. Further study is needed to examine the use of different self- and parent-report measures in different settings (e.g., pediatric offices, community mental health settings vs. hospital settings, general clinics vs. specialty clinics). While this report provides support for the CTA approach overall, specific cut-offs and CTAs would need to be assessed for predicting ADIS-derived diagnoses when the ADIS is administered independently for children and parents instead of jointly as it was in this study. Creating and testing algorithms with a range of informants, measures, and in different settings will increase knowledge about the value of this approach and the extent to which cut-offs need to be individually established in different situations and with different populations.

Limitations

There are several limitations to this study. First, administration of the ADIS to parents and children jointly has not been tested and it is unclear to what extent the results differ from those obtained in independent administrations. Second, administration of the ADIS was by clinicians of various disciplines and training levels, and in this naturalistic clinical setting we did not obtain measures of interrater reliability. Third, we examined predictors of three common anxiety diagnoses only, and it is not clear that this approach would generalize to other disorders. Fourth, this was not a research setting with clean inclusion and exclusion criteria, and families were self-presenting. It is possible that outcomes would differ with a less comorbid population or a more homogenous or randomly selected one. In addition, the order of administration of the various measures in this real-world clinical setting was at times variable and has the potential to influence accuracy in reporting. That said, the benefits of doing this research in a real-world setting is that it assesses the actual effectiveness of these assessment decision rules. Finally, it remains to be determined whether these assessment efficiencies are accomplished at the expense of having more comprehensive assessment data to guide actual treatment decisions. The ADIS may save time in the treatment process by providing information for the treating clinician to construct a fear hierarchy and formulate a specific exposure plan (Silverman & Ollendick, 2005) and by teaching families to rate severity and impact on functioning. However, there are many situations in which ADIS elimination generally saves time and money (e.g., absence of disorder [time saved not administering the ADIS]; insurance not covering extensive assessment; and lack of providers trained to administer the ADIS).

In addition, the ideal benchmark for classification efficiency should be examined further. This study used a conservative 80% benchmark to ensure diagnostic accuracy in the event that a child is assessed only once. However, in many clinical settings where diagnostic evaluations are conducted and treatment follows immediately thereafter, an ongoing reassessment and diagnostic refinement process is likely to occur. Under these circumstances, a lower (e.g., 70%) benchmark may be more reasonable. For example, if the child is to be assessed only once, the administration of the ADIS GAD section is appropriate and likely to increase diagnostic accuracy in a meaningful way if the parent CSI GAD scale is below the cutoff and the child SCARED GAD scale is above the cutoff. However, initial administration of the ADIS GAD section may not be needed if the child will be seen in treatment immediately because any mis-assignment of diagnosis using the 70% benchmark may be correctable through ongoing reassessment.

Conclusion

Evidence-based assessment is a critical element of evidence-based treatment. As with EBT, EBA must be replicable, effective, and efficient in a range of clinical settings. This study fundamentally advances our understanding of EBA processes by establishing that (a) in some situations, individual or combinations of multi-informant brief assessments can predict anxiety diagnoses in children as well as the ADIS and (b) ODA is an analytic technique that can reliably predict the situations in which brief assessments may be sufficient. To our knowledge, this is the first EBA study which has used ODA classification trees to establish cutpoint scores for each predictor in a way that does not require inputting the base rates of disorders. This approach thereby provides an easily applied method for determining the best possible EBA approach to anxiety diagnoses in real world settings where efficiency, patient satisfaction, and cost-effectiveness are important considerations.

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