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Psychometric development of The Autism – Tics, AD/HD and other Comorbidities (A-TAC) inventory. Full version with gate structure; based on clinic and general population data.

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ABSTRACT

Background: The Autism – Tics, AD/HD and other Comorbidities (A-TAC) inventory is a comprehensive screening interview for evaluating psychiatric problems – including autism - in children and adolescents. The A-TAC can be used for telephone interview.. A preliminary version has been validated (Hansson et al 2005). Items are organized in theoretically defined modules that cover autism spectrum disorders, AD/HD, tic disorders and other disorders known or assumed to be associated with these developmental conditions. This paper describes psychometric analyses of a revised version performed in order to arrive at the full version (A-TAC:FV, presented at this web-site www.childnps.se) which is currently subject to further validations and applied in several large-scale research projects.

Methods: Telephone A-TAC interviews with parents of 713 twins aged 9 or 12 years from the Child and Adolescent Twin Study in Sweden.

Results: Consistency was acceptable in all modules except Tics, Compulsions, Defiance, and Conduct problems for which new modules were developed. It was possible to omit a number of items while keeping sensitivity and specificity for dysfunction and/or distress high. The A-TAC:FV consists of 96 questions asked of all interviewees and 163 additional, branched questions, which are only asked if one or more of the items above the gates is endorsed. This “gate structure” renders the A-TAC useful and easily administered in large population based studies.

Key words: ADD/ADHD, Autistic disorder, Comorbidity, Prevalence, Tics, Screening.

INTRODUCTION

Studies of problems associated with childhood onset mental disorders in the general population are crucial for developing more adequate definitions. The Autism – Tics, AD/HD and other Comorbidities (A-TAC) inventory has been developed for the purpose of such studies as an easy-to-administer, dimensional and comprehensive interview assessing a broad scope of problems. New features that make the A-TAC unique include its: 1. roots in core autism spectrum problem areas (social interaction, communication and flexibility) and systematic assessment of almost autism overlapping or associated problem constellations, 2. validation as a telephone interview, 3. validation as a screening instrument (discriminant validity), and 4. validation as a dimensional measure (convergent validity).

This paper presents psychometric analyses that were used to identify the items included in the full version of the inventory presented as the A-TAC:FV at www.childnps.se and the development of the “gate structure” included in this version.

METHODS

Subjects

Parents of all Swedish twins who were either nine or twelve years old in July or August 2004 (n=496 pairs) were traced through the Swedish Twin Registry. This age span was chosen given that most of the major child psychiatric problem constellations have generally been established by that age, whereas the complex psychosocial problems associated with puberty have not yet emerged. The register contained information on 464 pairs in which both twins were alive. Parents of 7 pairs could not be contacted due to lack of information on their present whereabouts, and parents of another 89 pairs (19% of those approached) declined participation. The parents of the remaining 368 pairs participated in telephone interviews, but 15 of these completed the interview for only one of the twins, and parents of 4 pairs discontinued the interview before the A-TAC had been completed. This left a total of 713 individuals (184 boys aged 9, 178 girls aged 9, 175 boys aged 12, 176 girls aged 12 years) for the analyses presented in this paper.

Interviews

The A-TAC was developed so as to provide an interview-based inventory that, from a clinical viewpoint, assesses specific problems corresponding to major clinical diagnostic criteria. Problem areas that, in combined forms, constitute the constellations included in major childhood clinical diagnostic categories sets are assessed specifically without diagnostic hierarchies. The preliminary version included items tapping into autism spectrum disorders (ASD), AD/HD, tic disorders, learning disorders and motor dyscoordination. After the validation of this version, more items were added in order to improve specificity and a number of new modules were introduced, in order to assess more broadly possible overlapping problem constellations. The version applied in this study contained 337 items, 227 assessing symptoms and 100 assessing the age at onset of problems, their duration, and the dysfunction and/or personal suffering caused by the symptoms. A systematic reduction of the number of items without loss of sensitivity was considered an important step for screening purposes in the general population.

The A-TAC items are organized in modules (e.g., attention, impulsiveness and activity, social interaction, communication), targeting hypothetical areas of psychiatric/psychological problems based on theoretical assumptions. A preliminary version was validated in telephone in-

interviews with 111 parents of clinically diagnosed children and healthy controls (Hansson et al., 2005). It showed “excellent” screening properties for ASD and AD/HD, and “good” screening properties for learning disability, motor dyscoordination disorder, and tic disorders. The A-TAC yields dimensional ratings of symptoms and problem load in a broad range of possibly overlapping neurodevelopmental and psychiatric problems, as measured by specific problems included in diagnostic definitions of disorders such as autism and AD/HD. However, the A-TAC also covers the whole range of co-existing psychiatric problems among children.

The interviews were performed by a professional interview company, Intervjubilaget, by interviewers who had a brief introduction in child and adolescent psychiatry and twin research. The interviewer followed a computerized version of the A-TAC, and all responses were entered directly on to a database.

There were 227 individual items targeting symptoms or characteristics included in the A-TAC. The items are divided into modules as specified in Table 1. Each module consisted of 3 through 21 symptoms/characteristics, where the response categories were “no” (score 0), “yes, to some extent” (score 0.5), and “yes” (score 1.0). The **symptom score** (scores for all symptoms within each module added up) for a module was set to missing if 3 or more items in that module were answered with “do not know” or “do not want to respond”.

For each module in which at least one item was answered in the affirmative, the parents were also asked about whether or not there were problems for which the endorsed symptoms had led to. (1) dysfunction at school, among peers, or at home, or (2) suffering on the part of the child. A **problem load score** was calculated as the sum of the two items that assess dysfunction and suffering (thus ranging from 0 to 2), with a theoretically defined cut-off for problems to be considered a **significant problem**, that is, a problem load score at ≥ 1 , indicating either that one of the problem questions was fully endorsed or that both were endorsed “to some extent”. In order to be considered a valid value on the problem load score, information for at least one of the items was required. Finally, for each symptom/problem endorsed, age of onset, persistence and age of possible remission were documented.

Statistical methods

All statistical analyses were performed by the SAS 8.2 software (Sas Institute Inc., 2001). The consistency of the proposed modules was assessed using Cronbach’s alpha. For each module, we performed gradual inclusions in successive contingency tables depending on how many individuals with a significant problem load score each item was able to identify. The gradual inclusion of items stopped when the sensitivity could not be improved either because all “positive” individuals were already identified or because several items only identified one additional individual each. Items targeting DSM-IV criteria for ASD (referred to as Pervasive Developmental Disorders, PDD, in the DSM-IV) and AD/HD were all included in the screening algorithms regardless of psychometric considerations. Thus, for the modules Language, Social interaction, Flexibility, Concentration and attention, and Impulsiveness and activity, the gradual inclusion of items started with the DSM-IV items already included.

Ethical considerations

All informants consented to the study after written and oral information. All analyses were performed on anonymized data files. The study protocol was designed in accordance with the Helsinki declaration and approved by the ethical review board of the Karolinska Institute.

RESULTS

Analyses of consistency and misfit of items

Cronbach's alpha coefficients for each module are reported in Table 1. The contribution of each item to alpha was assessed, and items that reduced alpha were identified as detailed in the Table. Each item was also checked for its correlation with the problem load score in the relevant module. Items that reduced alpha or did not correlate with the overall problem load score ($p > 0.05$) were left out from the subsequent analyses and future versions of the instrument. However, some items (marked "c" in Table 1) that were uncorrelated with the proposed module but provided clinically specific information (such as food fads or severe over-weight) were kept and assembled under a new heading, Miscellaneous.

Generally, consistency turned out to be good to excellent for the following modules; Language, Social interaction, Flexibility, Concentration/attention, Impulsiveness/activity, Motor control, Perception, Learning, Planning and organizing tasks, Memory, Eating habits, Separations, Defiance, Anxiety, Mood, and Concept of reality. In contrast, there were some discrepancies or problems among the modules Tics, Compulsions, and Conduct. For these modules, decisions on possible reorganisations were based on theoretical assumptions and published diagnostic criteria sets rather than on psychometrics alone.

The Tics and Compulsions module showed poor consistency. An orthogonal factor analysis constrained to two factors, confirmed the heterogeneity of the constellation, yielding one factor corresponding to tics and another one corresponding to compulsions (data not shown). The module was therefore split into two, and the initial "problem load score" for the joint module was used for correlation analyses in both new modules.

Based on theoretical assumptions, and the overall poor internal consistency, the "Conduct" module was split into "Oppositionality" and "Conduct".

Questions relating to the age of remission of problems were answered inconsistently and therefore omitted.

Items with the best screening properties

The gradual inclusion of items for the identification of subjects with significant problems yielded sensitivities well over 0.90 in most cases (Table 2). For example, for the module Language, the four DSM-IV symptoms in Table 2 identified 22 of the 28 children with significant problems in this module. When the symptom "Does he/she talk in too high a pitch or too quietly?" was added, 25 children were identified. When all 6 items displayed in Table 2 for the Language module were included, 27/28 children with problems were identified, corresponding to a sensitivity of 96%. These 6 items - identified through the procedure described - will be used in future versions of the A-TAC as "gate items", i.e. informants on individuals who do not have any of these symptoms will not be asked for any other symptoms in the module.

For the future screening versions of the A-TAC, the "gate items" for Defiance will also be used for the Conduct module, as it is clinically motivated to assess conduct problems in children with oppositional defiant traits.

DISCUSSION

The A-TAC interview, originally developed and validated in clinical settings (Hansson et al, 2005) yielded psychometrically sound data in this sample of twins from the general population.

Psychometric properties of the A-TAC in the general population

Most of the hypothetical modules proposed for the A-TAC items showed high consistency, especially those representing the traditional “neuropsychiatric” area with ASD, AD/HD, learning and developmental disorders, but also mood problems, indicating that these modules represent core and important problem areas that should be targeted in clinical assessments. Previous non-clinical child and adolescent psychiatric interviews have relied on empirically defined assessments of problems in the general population, and, even though such assessments have a strong evidence basis, it remains problematic to interpret findings in clinical terms, especially with regard to neuropsychiatric conditions. The Childhood Behavior Checklist (CBCL) was initially developed according to empirical considerations (Achenbach, 1991), but has later been developed in accordance with DSM-IV categories (Achenbach & Ruffle, 2000). However, the relationship between the items in this checklist and clinically assigned diagnoses remains unclear (McGuire et al., 2000). In contrast, more elaborate clinical, interview-based, diagnostic schedules, such as the Kiddie-Schedule for Affective Disorders and Schizophrenia/K-SADS (Kaufman, Birmaher, Brent, Rao, & Ryan, 1996) and the Diagnostic Interview for Social and Communication Disorders/DISCO (Wing, Leekam, Libby, Gould, & Larcombe, 2002) may provide precise clinical diagnoses, but are less useful in non-clinical research. In general, they also focus on specific diagnoses without accounting for dimensionality or the complexity of co-existing problems. Our study shows that the A-TAC adds specific and new qualities to this arsenal of instrument for use in large cohorts.

The analyses presented in this paper also showed that it is possible to reach excellent sensitivity using a shortened version of the A-TAC with only the 81 items described in Table 2 to identify children with significant problems. This short version may provide an important tool for use in large-scale epidemiological studies, as well as in clinical screening. If all short-version items are negated in a module, no further questioning needs to be undertaken in that area. Conversely, those who respond affirmatively to any of these “gate items” will be asked all of the remaining questions in the module so as to improve clinical specificity.

Limitations of the study

Obvious limitations are inherent in the non-clinical diagnostics applied and in the use of one informant only. Twins may not be representative of the general population. Most empirical studies, however, have found no or very small differences between twins and singletons (Evans & Martin, 2000). The high degree of co-existing problems in this study may partly be explained by overall differences in response style where some parents admit a large number of problems, and others are “deniers” throughout. It does not seem likely that response style alone could account for most of the variance of the results of the study. Recall bias might have affected the results. However, there were very few significant differences between 9 and 12 year old children, supporting the conclusion that A-TAC generally succeeds in assessing symptoms and problems in a life-time perspective. However, recognition of opposition and conduct problems might be poorer than for other problem areas

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