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The latent classes of subclinical ADHD symptoms: Convergences of multiple informant reports

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ABSTRACT

The purpose of the present study was to conduct latent class analysis on the Hyperactivity scale of the Strengths and Difficulties Questionnaire in order to identify distinct subgroups of subclinical ADHD in a multi-informant framework. We hypothesized a similar structure between teachers and parents, and differences in symptom severity across latent classes. Data was collected from a non-referred sample of children aged 8–13 years. We performed latent class analyses on parent ($n = 383$) and teacher ($n = 391$) ratings of the Hyperactivity scale items from both versions of the questionnaire. Those children who had ratings from both informants ($n = 272$) were included in the cross-informant analyses, in which the similar or equivalent classes across raters were determined. A three-class solution for parent report and a five-class solution for teacher report emerged in the subsample of boys. For girls, a three-class structure for parents and a four-class structure for teachers were optimal. Besides non-symptomatic groups, mild and severe combined classes, mild inattentive–impulsive classes, and among boys, a mild hyperactive–impulsive class was obtained. The cross-informant analyses demonstrated that quite similar subgroups were detached regardless of informant; however, the teacher classes were somewhat more elaborated. The results are in line with the previous latent class analytic studies, and support the combination of dimensional and categorical approaches. The importance of milder symptoms and sub-threshold ADHD categories are emphasized for the fields of neuropsychology, neuroscience, and education, as well as for diagnosis and personalized treatment.

1. Introduction

Attention deficit/hyperactivity disorder (ADHD) is one of the most common child psychiatric disorders, with a prevalence rate of 5–10% in school-age children (Scahill & Schwab-Stone, 2000). The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000) offers a categorical approach to handling the question of subtyping, which is fundamental in the clinical practice and in many fields of research. It is unambiguous that the impairment and symptom presentation in ADHD are highly heterogeneous (e.g., Nigg, Tannock, & Rohde, 2010). However,

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much evidence has been provided as to the inconsistency of subtypes. The restrictive inattentive subtype, with few or no hyperactive–impulsive symptoms (e.g., Carr, Henderson, & Nigg, 2010; Hinshaw, 2001; Schmitz, Ludwig, & Rohde, 2010), and the purely hyperactive–impulsive subtype have been of much interest (Barkley, 1997; Lahey, Pelham, Loney, Lee, & Willcutt, 2005). Among the several sources of variance, which are ignored by the DSM-IV, and which affect the expression of the symptoms of ADHD, the most important ones are the following: gender differences, differences across informants, age-related changes (poor temporal stability of the subtypes), and co-morbidity (Hudziak, Achenbach, Althoff, & Pine, 2007).

The presence of mild and moderate attention and hyperactive–impulsive problems in community samples (e.g., Hudziak, Wadsworth, Heath, & Achenbach, 1999; Volk, Neuman, & Todd, 2005) suggests considering children who are at risk of developing the disorder, but do not meet the criteria for ADHD. Samples from clinical care might not be representative of the entire population with the disorder, because current diagnostic standards do not adequately capture subclinical or sub-threshold levels of ADHD. The concept of "subclinical variants" has been known for a long while (Scahill et al., 1999); earlier studies underpinned that milder forms of the disorder are characterized by the symptoms of ADHD without significant functional impairment (Costello & Shugart, 1992; Horwitz, Leaf, Leventhal, Forsyth, & Speechley, 1992). The importance of this subgroup becomes highlighted as risk factors are at evaluation, which are originally associated with more severe forms of the disorder (Lahey & Willcutt, 2010; Scahill et al., 1999). Nevertheless, early treatment and special educational training are worth considering (Todd et al., 2002).

There are several approaches to identifying children with subclinical ADHD. One approach is based on cut-off scores and percentiles, another is the use of latent class analysis (LCA) to identify subgroups. The application of different predetermined cut-off scores, high or low percentiles, or the combination of such methods on rating scales or on symptom counts could be controversial. However, designating a borderline or sub-threshold range regarding the distribution of attention/hyperactive–impulsive problems, and the assessment of sensitivity and specificity for different cut-off scores might be more effective (Scahill et al., 1999). The combination of categorical and dimensional approaches appears to be a fruitful consideration when the symptoms and symptom severity of ADHD are being evaluated (Hudziak et al., 2007). The clinicians and researchers should evaluate the degree to which ADHD is manifested aside from the presence or absence of the disorder.

The advantages of person-oriented approaches (Bergman, Magnusson, & El-Khouri, 2003) could be exploited on the grounds of the described heterogeneity in ADHD. Latent class analysis seems to be a suitable method for identifying various ADHD phenotypes on the basis of an individual's symptom endorsement probabilities. This method classifies the individuals who exhibit similar patterns of characteristics into distinct subgroups (Collins & Lanza, 2010). Previous research using various sources of data (different rating scales, interviews on symptoms of DSM-IV) for LCA provided well-interpretable and useful evidences regarding understanding the structure of ADHD, and regarding the refinement of genetic analyses (e.g., Hudziak et al., 1998, 1999; Neuman et al., 1999; Todd et al., 2001).

Some of the identified latent classes can be considered as alternative subtypes, which could serve as a basis for the further refinement of the original ones (for an example on the predominantly inattentive phenotype see Schmitz et al., 2010; Volk, Todorov, Hay, & Todd, 2009). A remarkable observation concerning the LCA studies is that the number of children classified into some latent class other than non-symptomatic varies in a wide range, from about 30 to 39.4% (Althoff et al., 2006) to 63% (Hudziak et al., 1999) in non-referred samples of boys. The clinically relevant and less severe latent class subtypes also had various deficits in cognitive and achievement testing, as well as increased use of special education, as it was the characteristic of the inattentive and combined DSM-IV ADHD subtypes (Todd et al., 2002). In this manner, the latent class analyses on various population samples are able to detach groups with subclinical variants of ADHD, which could vary in the continuum of symptom severity and in qualitative aspects.

The number of the latent classes that have emerged in earlier studies is somehow dependent on the instrument used: six-class and eight-class solutions were obtained using the DSM symptoms (e.g., Hudziak et al., 1998; Neuman et al., 1999; Rasmussen, Neuman, et al., 2002), and a three-class solution best fit the data when applying the Attention Problems scale of the Child Behavior Checklist (Hudziak et al., 1999). LCA classes on the basis of DSM items have appeared to be similar across cultures (Rasmussen, Neuman, et al., 2002; Rasmussen, Todd, et al., 2002; Rohde et al., 2001). By contrast, using subjective reports and various neuropsychological and IQ measures in a referred sample, results indicated that there was no underlying latent class structure of ADHD subtypes; instead, taxometric analyses supported a latent dimensional structure (Frazier, Youngstrom, & Naugle, 2007).

The reports of multiple informants could be essential to confirming impairments in multiple settings (e.g., at home and at school), but previous research on identifying subtypes has used parental reports as usual, and few studies have taken into account the teacher ratings of the symptoms (Althoff et al., 2006; de Nijs, Ferdinand, & Verhulst, 2007). However, the rater bias covers the fact that the teacher usually observes a child for a few months in a structured school-related context, whereas the parental observation is more extended over time and includes the behavior of the child at home and in different social contexts (Jonsdottir, Bouma, Sergeant, & Scherder, 2006; Valo & Tannock, 2010). Nevertheless, it is possible that these source effects reflect real differences in the behavior of children with teachers in a classroom setting and with parents at home (i.e., a kind of situational specificity, for details see e.g., De Los Reyes, 2011). Previous research indicated that even 50% of the children aged 6–12 years from a referred sample could be reclassified from one subtype to another depending on source variance (parent or teacher), instrumentation variance (semi-structured clinical interview or rating scale), and method variance (AND/OR) in combining the symptom reports across informants (Valo & Tannock, 2010). The use of different methods of combining symptoms, as reported by teachers using the behavioral rating scale and by parents through structured interviews, demonstrated the instability of subtype distribution in a community sample, as well (Rowland et al.,