LATENT STRUCTURE OF SWAN SCALE FOR ADHD

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Introduction

An approach that shows some promise for phenotypic refinement in ADHD is the use of latent factor models such as Latent Class Analysis (LCA) and Latent Profile Analysis (LPA). Latent models allow the investigator to examine the structure underlying a set of symptoms to help identify phenotypes that can be used for later genetic studies. Using this strategy for ADHD, a classification scheme slightly different from the DSM approach has been proposed by our group and others where response profiles tend to fall into 6 to 8 class solutions rather than a three class solution of the DSM. We have demonstrated similar latent structure using the CBCL AP scale and the Conners' Parent and Teacher Revised Scales.

Questions

1) Does use of a measure that included positively scored items provide similar or separable domains of pathology?
2) Is it would be possible to demonstrate the existence of classes where there is significant strength in attention sub-domains

Sample

The sample consisted of 177 Dutch twin pairs, born between 1990 and 1992, and 55 of their siblings. The twins were 12 years old (mean age= 12.42, SD= 0.16) and the siblings were between 8 and 15 years old. There were 41 monozygotic male twin pairs (MZM), 28 dizygotic male twin pairs (DZM), 56 monozygotic female twin pairs (MZF), 25 dizygotic female twin pairs (DZF) and 27 dizygotic opposite-sex twin pairs (DOS). Zygosity was determined on the basis of DNA polymorphisms.

Measures

The Strengths and Weakness of ADHD-symptoms and Normal-behavior (SWAN) scale is an 18 item scale containing both positively scored responses and negatively scored responses (eg. the question "Give close attention to detail and avoid careless mistakes" can be answered as "Far Below Average, Below Average, Somewhat Below Average, Average, Somewhat Above Average, Above Average, and Far Above Average). The SWAN has the advantage of having a near-normal distribution in general population samples (Hay et al, 2006)

Data Analyses

Latent Profile Analysis was performed on these Likert-scale ordinal responses using the program Latent Gold. Models were fitted by means of an EM algorithm. Models estimating 1-class through 10-profile solutions were compared. Additionally, mixed latent class/latent factor analyses (LCFA) were performed using the "factor" subprogram of Latent Gold. Models estimating up to 8 factors, each with up to 8 classes were compared. Covariates of Age, Sex, and Sibling Type (monozygotic or dizygotic twin or sibling) were included in all combinations included in the models.

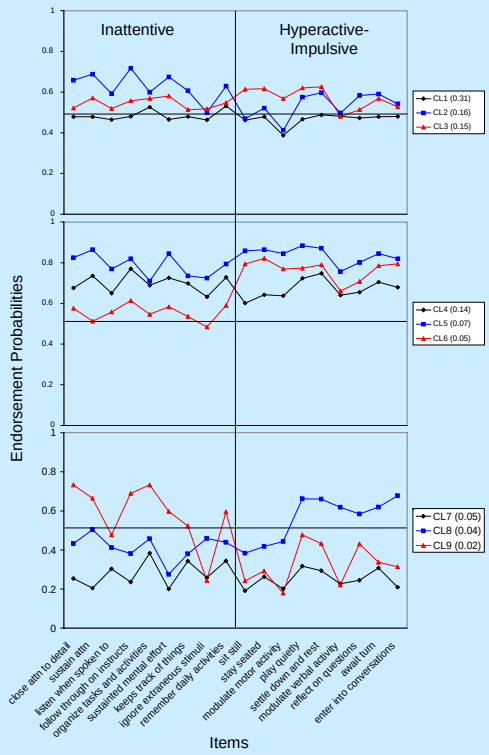
To calculate the best fitting model, we compared class solutions using the change in the Bayesian Information Criterion (BIC), the sample-size adjusted BIC, and the Consistent Akaike Information Criterion (CAIC), goodness-of-fit indices that consider the rule of parsimony.

Results

The LPA model profiles are shown in Figure 1. Lower endorsement probability = weakness and higher = strength. Below lists the class memberships and names that we have assigned to the classes.

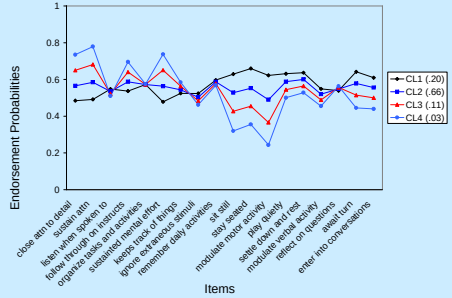
Class	Probability of Class Membership
1. No Symptoms	.31
2. Slightly better than average on only inattentive symptoms	.16
3. Slightly better than average mostly on hyperactive/impulsive symptoms	.15
4. Better than average on all symptoms	.14
5. Superb attention	.07
6. Better than average only on hyperactive/impulsive symptoms	.05
7. Combined attention problems	.05
8. Predominantly inattentive problems	.04
9. Predominantly hyperactive-impulsive problems	.02

Latent Profiles



LCFA Results

Preliminary data suggest that, on the basis of goodness to fit measures, a 5 factor model with 4 classes contained within each factor fit these data even better than the 9 class latent profile model. While "inattentive" "hyperactive" and "combined" factors emerged, so did a factor where inattention and hyperactivity were opposed to one another. This is presented below:



Discussion

These data suggest that there is an advantage to using a Likert-type scale for examining attention problems, because individuals can be identified who are impaired vs. individuals who have strengths in attention sub-domains. Moreover, the use of latent class factor analysis appears to identify particular individuals who show strength in one sub-domain and weakness in another. Because these are twin samples, these relationships can be explored in a genetically-informative fashion. Examination of twin pairs where one twin shows impairment and the other strength, especially in monozygotic twins where the genetic information is identical provides a unique opportunity to examine the role of the environment in the expression of genes, both in terms of pathology and wellness

References:
1. Hay DA, Bennett KS, Levy F, Sergeant J, Swanson J (2006), A Twin Study of Attention-Deficit/Hyperactivity Disorder Dimensions Rated by the Strengths and Weaknesses of ADHD-Symptoms and Normal-Behavior (SWAN) Scale. Biol Psychiatry

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