LATENT CLASS ANALYSIS OF THE CBCL OBSESSIVE-COMPULSIVE SCALE

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Introduction

Using data from the Childhood Behavior Checklist (CBCL) we have developed a scale that can be used to identify children with OCD. In our earlier work (Nelson et al., 2001), we identified 11 of the 119 CBCL items as being consistent with the behaviors of childhood OCD. We then used factor analysis to test and derive an Obsessive Compulsive Scale (OCS). A single factor accounted for 40.0% of the variance and, after simplification of the solution, consisted of 8 items. We then compared CBCL weighted factor scores for a cohort of pediatric OCD patients who had been diagnosed as having DSM-IV OCD with scores from clinically ascertained and general population controls. We demonstrated that the OCS from the CBCL had moderate sensitivity and high specificity to detect clinical OCD, with positive predictive value (PPV) ranging between 70.5% - 83.3% and negative predictive value (NPV) ranging between 88.2% - 91.6%.

In subsequent work, we have shown that a simple addition of the items placed into the analysis using a Receiver Operating Characteristic (ROC) curve analysis allowed for similar characteristics. Using a CBCL-OCS cutpoint of 5 demonstrated an Area Under the Curve (AUC) of 0.88 with high sensitivity (92%) and moderate specificity (67%) compared to clinical controls. Compared to the general population controls, the AUC was 0.96 with high sensitivity (92%) and specificity (89%) (Hudziak et al, in press). We have also shown using structural equation modeling that the OCS is influenced by genetic factors (~55%) and unique environmental factors (~45%) at ages 7 and 10 with common environmental influences only at age 12 (Hudziak et al, 2004).

Given the utility of Latent Class Analysis (LCA) for identifying heritable phenotypes in other childhood disorders (ADHD, Bipolar Disorder), here we investigated using LCA on the CBCL OCS to determine if any more specific phenotypes emerged and whether there was evidence of heritability within those latent classes.

Questions

1) Does the latent class structure of the CBCL OCS identify specific subtypes?
2) Is there evidence of heritability within the subtypes?
3) What are the implications of subtypes for childhood psychopathology?

Sample

In order to control for developmental differences in expression of OCS symptoms in a general population twin sample, we analyzed data from twins at ages 7, 10 and 12 from the Netherlands Twin Registry. The NTR currently has CBCL data about more than 25,000 twin pairs from age 3 to 30. Participants were chosen at ages 7, 10, and 12. Participants were excluded if any of the 8 OCS items were not completed. OCS items from each of the 8968 remaining 7-year old participants, 5742 10-year old participants, and 3674 12-year old participants was computed.

Measures

The CBCL (Achenbach, 1991) was used to measure eight behavioral and emotional syndromes.

Items from the OCS were extracted and truncated such that scores of 1 or 2 were considered "present" and 0 was considered "absent". The items of the OCS are (as numbered by the CBCL):

9. Can't get his/her mind off certain thoughts; obsessions
31. Feels he/she might think or do something bad
32. Feels he/she has to be perfect
52. Feels too guilty
66. Repeats certain acts over and over; compulsions
84. Strange behavior
85. Strange ideas
112. Worries

Data Analyses

Latent class analysis was performed using Latent Gold. Participant response profiles on the 8 items were placed into the analysis separately for boys and girls.

Latent class models were fitted by means of an EM algorithm. Models estimating 1-class through 5-class solutions were compared. To calculate the best fitting model, we compared an M class solution to an M+1 class solution using the change in the Bayesian Information Criterion (BIC), a goodness-of-fit index that considers the rule of parsimony.

Odds ratios between classes were then computed and examined for differences between MZ and DZ twins both within and across latent classes.

Results

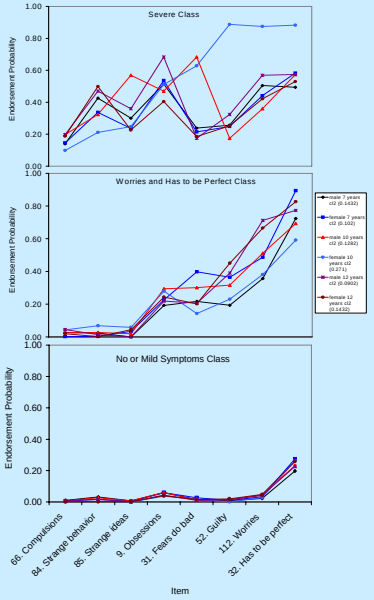
Regardless of age group, sex, or sample, for the 1-class, 2-class and 3-class models, the models were significantly more likely than chance as measured by bootstrapping. As the number of classes increased from 1-class to 2-class and from 2-class to 3-class, the AIC and BIC either decreased appreciably or the increase was minimal. Thus, a 3-class model was considered the minimal acceptable model.

The classes are shown graphically in the next pane and seemed to represent a "No or Mild Symptoms" class, a "Worries and Has to be Perfect" class and a "Severe Symptoms" class in descending order of class membership for both boys and girls at all ages.

Class Membership Results

Age	Class	Probability of Class Membership	
		female	male
7	No Symptoms	0.83	0.79
7	Worries and Has to be Perfect	0.10	0.14
7	Severe Symptoms	0.06	0.07
10	No Symptoms	0.69	0.81
10	Worries and Has to be Perfect	0.27	0.13
10	Severe Symptoms	0.04	0.08
12	No Symptoms	0.82	0.83
12	Worries and Has to be Perfect	0.14	0.09
12	Severe Symptoms	0.04	0.08

Item Endorsement Probabilities



Heritability Results

MZ twins had higher odds ratios within latent class than DZ twins. Both types of twins showed higher odds ratios within than across latent classes. Comparing the odds ratios to those performed using the criterion of an OCS score >= 5 showed that for ages 7 and 12 the LCA odds ratios were higher than using raw scores.

Age	Class	DZ			MZ		
		No Sx	Worries	Severe	No Sx	Worries	Severe
7	No Sx	**5.10**	0.24	0.23	**16.17**	0.08	0.10
	Worries	0.25	**4.72**	1.99	0.09	**16.98**	1.67
	Severe	0.22	1.83	**7.34**	0.11	1.19	**28.93**
10	No Sx	**3.28**	0.32	0.42	**12.16**	0.12	0.05
	Worries	0.36	**3.03**	1.25	0.12	**8.26**	3.07
	Severe	0.29	1.88	**6.13**	0.09	2.55	**36.01**
12	No Sx	**4.47**	0.22	0.36	**11.14**	0.09	0.21
	Worries	0.29	**3.79**	1.69	0.12	**14.45**	0.97
	Severe	0.24	3.39	**3.87**	0.16	0.77	**21.28**

Age	Twin Type	Using OCS >=5
7	DZ	6.76
	MZ	25.50
10	DZ	9.31
	MZ	63.14
12	DZ	27.19
	MZ	24.38

Discussion

Latent class analysis identifies two subtypes within the OCS of the CBCL. These subtypes may be more heritable than OCD identified using the OCS alone, especially at later ages, offering another prospect of increased specificity for the genotyping of OCD, especially in samples which already have CBCL data on large populations.

There are reasons to consider the use of LCA in genotyping studies as a way to further refine phenotypes when searching for genetic relationships and gene x environment interactions in OCD. Such analyses are currently underway.

References:

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