

Cross-Informant Agreement on Child and Adolescent Withdrawn Behavior: A Latent Class Approach

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Abstract Withdrawn behavior (WB) relates to many developmental outcomes, including pervasive developmental disorders, anxiety, depression, psychosis, personality disorders and suicide. No study has compared the latent profiles of different informants' reports on WB. This study uses multi-informant latent class analyses (LCA) of the child behavior checklist (CBCL), teacher report form (TRF) and youth self-report (YSR) to examine phenotypic variance in WB. LCA was applied to the CBCL, TRF and YSR of 2,031 youth (ages 6–18); of which 276 children were clinically-referred. A 4-class solution for the CBCL and 3-class solutions for the YSR and TRF were optimal. The CBCL yielded low symptoms, predominantly shy or secretive moderate symptoms, and all symptoms classes. The TRF lacked the moderate—secretive class, and the YSR lacked the moderate—shy class. Agreement was low. LCA shows similar structure of withdrawn behavior across informants but characterizations of moderate WB vary.

Keywords Withdrawn behavior · Social withdrawal · Child behavior checklist · Teacher's report form · Youth self-report

Introduction

Withdrawn behavior, which includes symptoms of inhibition, shyness, anxiety and avoidant behavior can present early in childhood, has high prevalence and is neither time-limited, nor benign. As early as two years of age, 10–15 % of children can be characterized as shy and are at risk for social anxiety and avoidance in adulthood [1]. Children with anxious and withdrawn behavior experience loneliness and negative self-regard as teens [2] and are also at risk for major depressive disorder, panic disorder with agoraphobia, and social phobia in adolescence and adulthood [3]. Withdrawn behavior has also been explored as a precursor to avoidant personality disorder [4] and as a component of the prodrome for schizophrenia [5].

One measure of withdrawn behavior is the withdrawn behavior subscale (WBS, Table 1) of the Achenbach system of empirically based assessment (ASEBA). The ASEBA scales include the child behavior checklist (CBCL), Teacher Self Report Form (TRF) and the youth self report (YSR). Elevated scores by parent report on the WBS early in childhood not only are a stable and strong predictor of WB across the life span, they are also associated with elevations on all of the seven syndrome subscales of the CBCL, albeit lower elevations than on WB itself [6]. In addition, early elevations of the WBS by parent report predict a broad range of problems in adulthood including elevated self-reported internalizing and externalizing scales [6]; elevated DSM-III-R total symptom score and functional impairment [7]; and risk for later

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Table 1 Items from the WBS

| |
|---|
| Too shy or timid |
| Withdrawn, doesn't get involved with others |
| Would rather be alone than with others |
| There is very little that he/she enjoys |
| Refuses to talk |
| Underactive, slow moving or lacks energy |
| Unhappy, sad or depressed |
| Secretive, keeps things to self |

suicide attempts [8]. Elevated WBS scores also correlate with the presence of specific diagnoses including major depression, dysthymia, generalized anxiety disorder [9], social phobia [10], subsequent onset of schizophrenia in high risk adolescents [5], and autism spectrum disorders in a combined referred and non-referred population of children [11]. The WBS of the TRF has been useful in the assessment of children with selective mutism [12].

Significant correlations between WBS scores and neuropsychological measures of global intellectual functioning, language, executive functioning, processing and psychomotor speed, dominant hand coordination and basic math skills have been identified [13]. Withdrawn behavior is also stable across cultures [14] and appears to have approximately half additive genetic contributions and half environmental contributions to its presentation [15].

The pathways from withdrawn behavior in childhood to pathology in adulthood are heterogeneous, and not well understood. Latent class analysis (LCA) is a way to test empirically for discrete patterns of symptoms and has the potential to shed light on the various types of withdrawn behavior. The utility of LCA in elucidating patterns of symptom structure and severity in measures of psychopathology, including DSM and ASEBA scales, has precedent in numerous studies and over a wide range of datasets and syndromes [16–22]. Previous studies examining LCA across informants have provided a more nuanced understanding of the relative weight of different informants in evaluating particular aspects of a syndrome. For example, the LCA of Attention Problems, Anxious/Depression, and Aggressive Behavior across informants demonstrated the relatively low weight given to internalizing symptoms by teacher reports, even in the most extremely affected individuals [23]. The discovery of latent classes allows for targeted genetic, epigenetic, neuroimaging and related studies aimed at the differentiation of this observable pattern of behavior. The aim of this study was to apply latent class analysis to the Withdrawn Behavior subscale in a large sample of children to explore the possibility of subgroupings of individuals based on their withdrawn

behavior. We then sought to examine cross-informant agreement utilizing TRF and YSR data that was available on the same individuals in an attempt to explore inter-informant reliability on subgroupings of withdrawn behaviors. We hypothesized that classes of WB would have inter-informant reliability at levels that are the same or better than the overall scale. We finally hypothesized that a subset of referred children in the sample would be classified into the class with the highest level of severity.

Methods

Participants and Procedures

Participants were 2,031 youths ranging from 6 to 18 years of age. This sample was first collected in 1999 [24]. Temple University's Institute for Survey Research (ISR) was commissioned to provide 100 primary sampling units (PSR) that would be representative of the 48 contiguous states collectively. Within each PSR 150 households were visited by interviewers selected and trained by ISR to determine the age of residents and to assure that each household had at least one guardian that spoke English, and that the children were neither mentally retarded nor physically handicapped. Participants were limited to one per household and were selected randomly. Interviewers sent completed CBCL, TRF and YSR forms to ISR where they were checked for completeness. If any data was missing, interviewers were notified to collect the outstanding data. Finally, all respondents were called by trained ASEBA staff to verify that interviews had been conducted as they were reported. Participants received \$10 for completing their forms. 276 children were children and adolescents who had been clinically referred for mental health services and 1,755 represented a non-clinically referred population. 53 % of participants were boys, with a mean age of 11.94 (SD = 3.56). The mean age for the girls was 12.03 (SD = 3.50). Data collected included the CBCL for parent or guardian report, the YSR, the TRF and other questions pertaining to the participants' special education histories, mental health statuses and demographics. YSR data was unavailable for the children under age 11. 687 participants (52 % male) had full cross-informant data available on from the CBCL, YSR and TRF. The Hollingshead scale [25] revealed that participants for whom all three informants' data was available had a higher socioeconomic status (SES) than those missing one or more informants' responses. (Mean standardized SES 57.16 for participants with complete data versus 53.70 for participants with incomplete data, $F = 10.12$, $p < 0.002$). Informed consent was obtained from all participants.

Measures

Withdrawn behavior was measured with the CBCL, YSR and TRF [24]. The items that comprise the WBS on the CBCL are identical to those in the TRF and YSR. Parents, youth, and teachers rated 112 (YSR) or 113 (TRF, CBCL) items related to the behavior of the child over the preceding 6 months on a 3-point scale. Items are scored by the informant on a scale from 0 (“not true”) to 1 (“somewhat true”) to 2 (“often true”). As per previous recommendations, [26] scores of 1 and 2 were collapsed as positive responses with the scores of 0 representing the negative response, creating a dichotomous variable for the purposes of the latent class analysis. This truncation has considerable precedent as a standard for placing CBCL items into LCA [19, 21, 27, 28]. The Cronbach’s Alpha of the parental CBCL scale with trichotomous items is 0.72 while the KR-20 of the scale with dichotomous items is 0.70. We also explored using the variables as fully-ordinal variables. The overall profiles were the same, as were the number of latent classes, similar to work that we had done previously [23]. However, the bivariate residuals of the best models were larger, demonstrating a poorer fit than using dichotomous variables, and we consequently chose to use dichotomous variable definitions for all three instruments.

As a post hoc analysis, the date of TRF completion was examined as a correlate of LCA classification for teacher reports, given that “secretive” behaviors of a student may be less ambiguous for a teacher reporting about the child later in the school year. Of note, despite wide differences in classroom structure between ages 6–18, the syndrome structure of the TRF remains the same, regardless of age [24].

Latent Class Analysis

Mutually exclusive classes that could account for the observed symptom endorsement profiles were identified by LCA. Unlike factor analysis, which searches for latent statistical association among continuous variables to group this set of variables together, LCA presupposes the existence of unobserved discrete categories of individuals with particular item response patterns. In this way, LCA is a person-centered approach while factor analysis is a variable-centered approach. It is possible for LCA to reveal latent differences in severity, as opposed to discrete classes, but it is a technique that is particularly good at discovering specific classes of responding. Output from an LCA includes the probabilities of class membership for each individual and symptom endorsement probabilities for each class. Within a particular solution, each class is assumed functionally independent [29].

Latent class models were fitted using the program Latent Gold [30] by means of an expectation maximization (EM)

algorithm [31, 32]. 1 through 5 class models were estimated. Using all available data for every given informant, LCA was performed separately on CBCL, YSR and the TRF using only the nonreferred participants. Afterwards, children who had been referred were placed into these classes to see where they would be classified. Individuals who did not have data for a particular informant were placed into the class with the lowest overall item endorsement probability, which is the class with no or few symptoms.

Best fitting models were determined by examining the bivariate residual pattern and a measure of parsimony the Bayesian Information Criterion (BIC). Latent Gold allows for Monte Carlo simulation to approximate a *p* value for the estimation. The program automatically generates a specified number of replication samples (in this case, 500) from the maximum likelihood solution and re-estimates the mode. The *p* value generated represents the proportion of replication samples with a higher log-likelihood than the original sample. *p* values greater than 0.05 indicate an adequate model fit. We first fit 1–5 class solutions for each informant separately including sex and age as covariates. We examined the pattern of bivariate residuals and the BIC and chose what appeared to be the best fitting model. We then ran bootstrapping to see if there were other models that also fit the data better. Next, we dropped the covariates individually and the BIC was examined again. Finally, we attempted to reduce any remaining significant bivariate residuals by including direct regression effects between variables in the model. Specifics regarding the individual informant model fits are provided with the supplemental material.

Once the most parsimonious class solution was determined for each informant, we equated classes by calculating the lowest Euclidean distance using the squared differences of item endorsement probabilities [33]. The program SPSS [34] was used to compute Chi-square statistics and Cramer’s *V* to measure the significance and strength of the nominal-to-nominal associations across informants. After dummy-coding classes into presence versus absence in a particular class, logistic regression was used to determine the odds ratio between informants as an index of the effect size of agreement. Cohen’s Kappa was also estimated. For further confirmation, Pearson correlations were computed between the posterior probability of latent class membership for all instruments to allow for a comparison of the cross-informant associations within the latent class framework.

Results

LCA Results

The best fitting models, supported by the lowest BIC value, were a 4-class solution for CBCL, a 3 class solution for

TRF, and a 3 class solution for YSR. See supplemental information for more details Fig. 1, 2, 3, 4.

Two of the latent classes, representing the two extremes of symptom endorsement, were identified by all informants. The few or no symptom class (class 1) was identified as 63 % of the non-referred sample by parents, 71 % by teachers and 49 % by the youth. The all symptoms class (class 4) was identified as 7 % of the non-referred sample by parents, 9 % by teachers and 14 % by the youth. For the two moderate symptom severity classes identified by the CBCL, labeled as shy (class 2) and Secretive (class 3), the TRF and YSR data each identified only one or the other of the two classes. These classes yielded moderate overall endorsement of symptoms with isolated peaks on either the shy or secretive item. The TRF identified the shy class as 20 % of the non-referred sample. This class was similarly

identified as 10 % of the non-referred sample by the parents on the CBCL. The YSR data endorsed instead the moderate symptoms—secretive class as 38 % of the non-referred sample. The CBCL data identified this moderate symptoms—secretive class as 21 % of the sample. When the referred sample was fit along with the nonreferred children in a separate LCA, referred children were significantly more likely to fall into the most severe, all symptoms class (18.8 % referred, 6.6 % nonreferred, $\chi^2(3) = 74.652, p < 0.01$).

Agreement Across Informants

Overall, associations across informants were numerically low, although they were consistent with those generally seen in psychopathology using the CBCL and related instruments

Fig. 1 Few or no symptoms

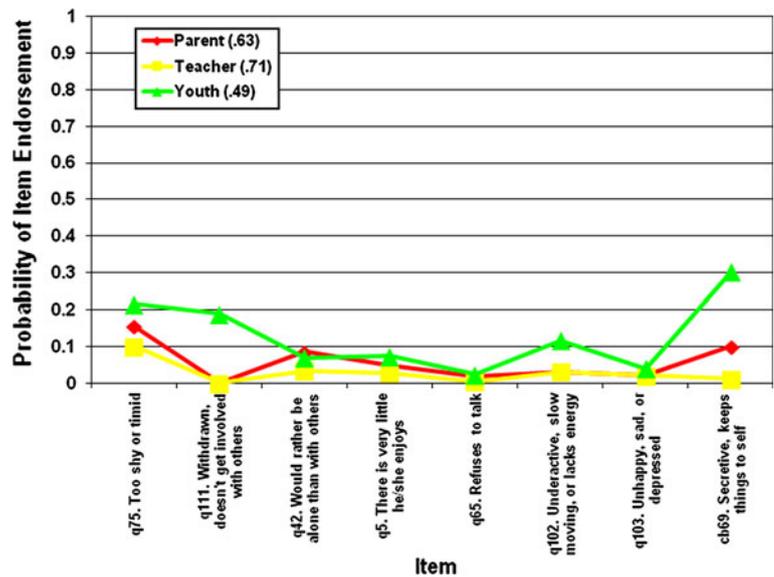


Fig. 2 Moderate symptoms—secretive

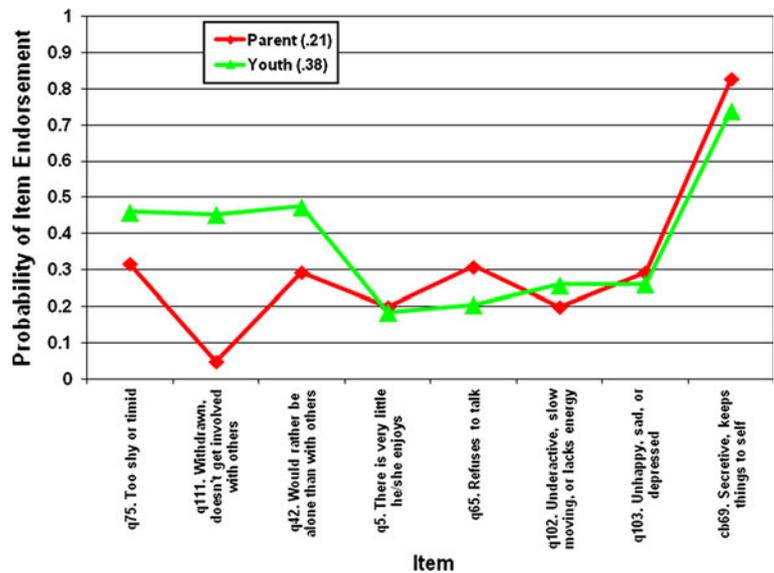


Fig. 3 Moderate symptoms—shy

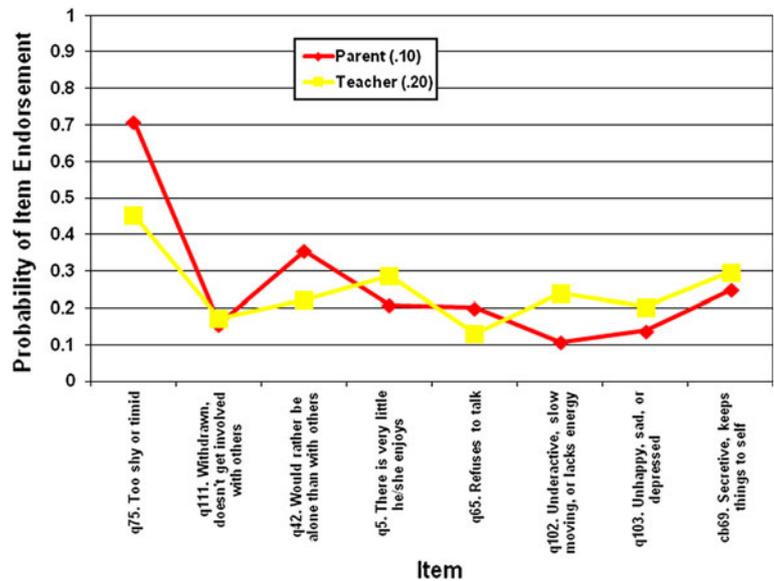
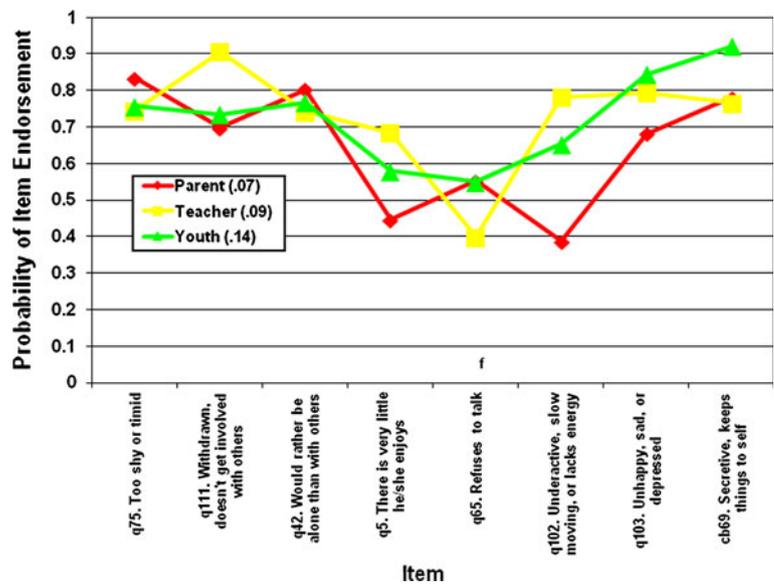


Fig. 4 All symptoms



[35] and consistent with the findings from the cross-comparisons to the Withdrawn scale as a whole [24]. Looking only at significance levels, the nominal associations across informants were significant across all comparisons via Chi square with the exception of YSR compared to TRF in the non-referred sample. All agreements were low but statistically significant with the exception of the comparison between YSR and TRF. (Cramer's V statistics across the three informants: parent-teacher 0.15, $p < 0.001$; parent-youth 0.21, $p < 0.001$; youth-teacher 0.08, $p = 0.092$).

The cross-tabulation of class assignment across informants and the corresponding odds ratios are presented in Table 2. Pearson correlations on the posterior probabilities of latent class membership are provided in Table 3 and are generally consistent with the findings from the categorical

cross-tabulations. Looking first at parent and youth agreement, the odds ratio of being placed into the few or no symptoms class for parents given that the youth by self report was classified into the few or no symptoms class was 2.96 (CI = 2.29–3.82). Comparison between the all symptoms class by parents and youth also demonstrated a significant odds ratio of 2.96 (CI = 1.80–4.86). Youth that placed themselves in the moderate symptoms—Secretive Class had a higher probability of being placed in either the moderate symptoms—Secretive (OR 1.57, CI = 1.02–2.44) or all symptoms classes by their parents (OR 2.96, CI = 1.80–4.86). Even with these significant OR's, though, the Pearson correlations demonstrate that the amount of variance explained across informants between parents and self report was around 3–6 %.

Table 2 Odds ratios (with 95 % confidence intervals) of cross-informant comparisons

| | Class | Youth | | | Teacher | | |
|---------|--------------------|--------------------|--------------------|------------------|--------------------|------------------|------------------|
| | | Few or no symptoms | Moderate—secretive | All symptoms | Few or no symptoms | Moderate—shy | All symptoms |
| Parent | Few or no symptoms | 2.96 (2.29–3.82) | 0.61 (0.47–0.78) | 0.30 (0.21–0.43) | 2.03 (1.53–2.70) | 0.56 (0.40–0.77) | 0.54 (0.35–0.84) |
| | Moderate—secretive | 0.48 (0.37–0.63) | 1.40 (1.10–1.83) | 2.14 (1.50–3.10) | 0.75 (0.53–1.05) | 1.37 (0.94–2.00) | 1.10 (0.64–1.91) |
| | Moderate—shy | 0.54 (0.27–1.01) | 1.52 (0.79–2.90) | 1.43 (0.62–3.30) | 0.48 (0.31–0.74) | 2.43 (1.54–3.84) | 0.94 (0.44–2.02) |
| | All symptoms | 0.28 (0.17–0.48) | 1.57 (1.02–2.44) | 2.96 (1.80–4.86) | 0.50 (0.30–0.82) | 0.94 (0.50–1.74) | 3.90 (2.14–7.10) |
| Teacher | Few or no symptoms | 1.46 (1.03–2.08) | 0.89 (0.62–1.28) | 0.58 (0.36–0.94) | – | – | – |
| | Moderate—shy | 0.67 (0.45–1.00) | 1.26 (0.84–1.89) | 1.43 (0.83–2.46) | – | – | – |
| | All symptoms | 0.84 (0.49–1.44) | 0.85 (0.48–1.51) | 1.83 (0.91–3.58) | – | – | – |

Table 3 Pearson correlations for CBCL, YSR, and TRF comparisons

| Informant | Class | Youth | | | Teacher | | |
|-----------|--------------------|--------------------|--------------------|--------------|--------------------|--------------|--------------|
| | | Few or no symptoms | Moderate—secretive | All symptoms | Few or no symptoms | Moderate—shy | All symptoms |
| Parent | Few or no symptoms | 0.254** | –0.137** | –0.207** | 0.130** | –0.096** | –0.075* |
| | Moderate—secretive | –0.285** | 0.193** | 0.187** | –0.043 | 0.058 | –0.006 |
| | Moderate—shy | 0.133** | –0.115** | –0.059 | –0.052 | 0.066* | –0.003 |
| | All symptoms | –0.203** | 0.097** | 0.179** | –0.128** | 0.031 | 0.151** |
| Teacher | Few or no symptoms | 0.083* | –0.035 | –0.079** | – | – | – |
| | Moderate—shy | –0.074* | 0.052 | 0.047 | – | – | – |
| | All symptoms | –0.033 | –0.012 | 0.060 | – | – | – |

** Correlation is significant at the 0.001 level (2-tailed)

* Correlation is significant at the 0.006 level (2-tailed)

With respect to parent and teacher agreement, if teachers classified students into the few or no symptom Class, the odds ratio of parents doing the same was 2.03. If teachers rated the children such that they fell into the all symptoms class, the odds ratio of the parents assigning the same class was 3.90 (2.14–7.10). Children evaluated by teachers to be in the moderate symptoms—shy class were placed in the same class by parents with an odds ratio of 2.43 (1.54–3.84). The amount of variance explained across teacher and parent classes was, again, quite low.

As stated previously, the YSR and TRF were found to have the least agreement of all informant comparisons, numerically and statistically. The only significant agreement between teachers and youth was that if the youth identified themselves in the few or no symptoms class, the odds ratio of the teacher placing them in the same class was 1.46 (1.03–2.08). There was a significantly low likelihood of teachers placing a youth sorted to the All Symptoms Class by self-report into the few or no symptoms class.

Increased familiarity with students was not associated with a greater likelihood of endorsing a “secretive” quality

in students. The overwhelming majority of teacher evaluations were completed late in the school year. Teachers failed to identify students as secretive even after this extended period of observation.

Discussion

The WBS of the CBCL, and its counterparts in the TRF and YSR, serve as a valuable screening tool in the identification of withdrawn behaviors in children. The data presented here demonstrates that, regardless of informant, these behaviors segregate into readily identifiable classes: few symptoms, moderate symptoms and all symptoms classes, with the moderate and severe classes capturing the majority of the children referred for treatment. The moderate symptoms class is distinguished by a preponderance of either “shy” or “secretive” characteristics. These classes are qualitatively similar across informants and, given the readily observable nature of withdrawn behavior in children and adolescents, it is not surprising that the youth,

parents, and teachers generally appreciate these characteristics in children. However, each informant offers different insights into children's withdrawn behavior and the agreement within latent classes, across informant, is generally not higher than the WBS as a whole. Youth who are described by their parents as shy and moderately symptomatic rate themselves as severely symptomatic. Teacher reports do not reconcile with youth self-reports. Qualitatively, teachers do not view children as secretive, even with increased familiarity with students over the course of the school year. Despite the stability of the TRF across this age range, there is the possibility that differences in teacher-student relationships from ages 6–18 might affect these results.

Generally higher parental agreement with both child and teacher versus the comparison between child and teacher may be arrived at through different and distinct commonalities among the informants. Lack of agreement among informants may reflect informant characteristics such as variations in gender, age, or psychopathology and the settings in which the child is observed. More likely, as these symptoms are internalizing and less available to teacher observation than externalizing behavior, it may be that teachers simply do not discern these symptoms.

Parental reports may reflect their unique, longstanding and primary role in their child's life. Qualitatively, parents and youth agree about three classes, but do not agree about moderate—shy behavior. Youth identified by parents as moderate—shy rated themselves as severe. One possible explanation is that the identification of children by their parents as “shy” results in a normalizing effect with regard to the parents' perceptions of their child's symptom severity. For parents, identification of a child as “shy” may be explanatory in and of itself for other behaviors on the subscale, and therefore result in a rater bias that underestimates the severity of their child's symptoms. For example, a “shy” child, in a parent's eyes, does not “refuse to talk” but rather the child is simply “shy” and as a result does not talk as readily compared to peers. Other items may be similarly discounted and down rated by parents. Shy behavior may have further impact on the parent–child relationship, further influencing both informants' reports. These theoretical considerations should be tempered by the limitations inherent to this exploratory method. The latent class findings demand further investigation to understand to what extent they represent a true distinction in nature or perspective.

Parents and teachers also share an adult observer perspective; hence their overall higher agreement about the severity of youth withdrawn behavior. However, teacher reports may lack the intimate knowledge of the child from which parent reports benefit. Large class size, limited student–teacher involvement and student body composition

may result in underreporting of mild or moderate withdrawn behavior by teachers, especially if the behavior does not manifest itself in overt or disruptive behaviors. In addition, teachers may be disadvantaged relative to other observers in identifying subtle distinctions of withdrawn behavior. For example, teachers did not identify a moderate—secretive class as parents and youth did. This is consistent with Achenbach's earlier findings that teachers rarely endorse the secretive symptom [24]. Our hypothesis that teachers might be more likely to identify secretive withdrawn behavior later as compared with earlier in the school year was not supported by our post hoc analysis. It is possible that teachers' knowledge of students may not reach the level necessary for them to characterize students as secretive or that teachers may, if aware of secretive behavior, be unwilling to describe their students as such. These findings are consistent with similar studies suggesting that teachers are less likely to agree with youth self-assessment of internalizing symptoms [36].

The challenge of distinguishing “secretive” from “shy” likely reflects parent–child–teacher interactions, multi-informant based evaluation, and the characteristics and classification of withdrawn behavior. With the exception of the YSR, all of these instruments are based on the observers' perception of the child and include information from direct observation, interaction with the child and observations of others. The CBCL asks the parent not only to report an observation but also to assess volition and motivation behind a behavior. Responses reflect characteristics of the informant and the relationship of the informant to the child, within the limitations of structured questionnaire-based assessment. For example, few would disagree that the item “doesn't get involved with others” better approximates an objective observation, whereas “refuses to speak” is an assessment of the child's motivation. Interestingly, parent and youth both qualitatively demonstrated secretive classes, but the parents also noted shyness. Observation of shyness or secrecy may vary between informants observing identical behavior. The Shy and Secretive classes may be similar expressions of the same latent withdrawn construct. The informant's assessment may simply reflect his or her own relationship to, and behavior with, the youth.

The Withdrawn Behavior subscale does not directly overlap with any specific DSM-IV diagnostic entity, although in the 1999 CBCL, the subscale has been termed Withdrawn/Depressed to emphasize the strong relationship between withdrawn behavior and depression and to allow for comparisons to the anxious/depressed subscale. A number of WBS items are consistent with depression, and in particular melancholia. These include anhedonia, decreased energy, hypokinesia, and sad mood. Others reflect the social function of withdrawn behavior, including

avoidance of social interaction, as well the possible motivation or preference for this avoidance. As a result, elevations in the WBS suggests depression and social withdrawal; however, elevations in the WBS can also be a departure point for other diagnostic entities including pervasive developmental disorders, anxiety disorders, psychotic disorders, and avoidant and schizoid personality disorders. Perhaps the greatest clinical relevance of these data lies in whether future longitudinal studies will find these identified latent classes at particular ages, or with particular consistency through childhood, or as predictive of certain diagnostic trajectories.

Summary

This study examined the role of multi-informant reporting to examine phenotypic variance in withdrawn behavior for the pediatric population. Latent class analysis was applied to the CBCL, YSR and TRF for 2,031 youths representing a cross-section of the contiguous United States, ages 6–18. All informants similarly identified low, moderate and high withdrawn behavior, however, moderate withdrawn behavior was variably characterized as either predominantly “shy” or “secretive” depending on the informant. This study suggests an overall consistency with respect to the identification of withdrawn behavior in children among varying informants, with nuanced characterization of those moderately affected particular to each informant. Identification and interpretation of withdrawn behavior is a first step in considering the many developmental outcomes foreshadowed by withdrawn behavior, including pervasive developmental disorders, anxiety, depression, psychosis, personality disorders and suicide.

Conclusions

LCA of withdrawn behavior has the potential to distinguish subtle differences in the presentation, classification and, possibly, treatment of one of the earliest observable phenomenon in developmental psychopathology—withdrawn behavior. Earlier identification and characterization of withdrawn behavior in children is paramount in importance. It is a core neuropsychiatric symptom for a host of developmental trajectories, including progression toward depression, anxiety, pervasive developmental disorders, psychosis, personality disorders, suicide and violence. We have demonstrated here that there are classes, qualitatively similar across informants, which are associated with subtle differences in the type of withdrawn behavior. As the field advances, with genotypic and phenotypic refinement through neurobiological markers and empirically based

assessments, the field stands to benefit from increasingly sophisticated approaches to anticipating the developmental trajectories in withdrawn children.

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