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Empirically Derived Subtypes of Child Academic and Behavior Problems: Co-Occurrence and Distal Outcomes

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Abstract

The aim of this study was to identify classes of children at entry into first grade with different patterns of academic and behavior problems. A latent class analysis was conducted with a longitudinal community sample of 678 predominantly low-income African American children. Results identified multiple subclasses of children, including a class with co-occurring academic and behavior problems. Gender differences were found in relation to the number of identified classes and the characteristics of academic and behavior problems for children. Several of the identified classes, particularly the co-occurring academic and behavior problems subclass for both genders, predicted negative long-term outcomes in sixth grade, including academic failure, receipt of special education services, affiliation with deviant peers, suspension from school, and elevated risk for conduct problems. The finding that subclasses of academic and behavior problems predict negative long-term outcomes validates the importance of the identified classes and the need to target interventions for children presenting with the associated class characteristics. Implications for early identification, prevention, and intervention for children at risk for academic failure and disruptive behavior problems are discussed.

Keywords

Academic underachievement; Behavior problems; Latent class analysis

Academic underachievement and disruptive behavior are serious problems afflicting a large number of children and adolescents. Separately, academic and behavior problems have been associated with substantial costs to families and society. Much has been written about the deleterious outcomes associated with life course persistent or early starter pathways to antisocial behavior problems (Patterson et al. 1991; Moffitt 1993). In particular, children with early behavior problems have an elevated risk for academic failure, peer rejection, substance abuse, and delinquency. Research has also shown that early learning problems by themselves predict future academic underachievement, school drop out, and other negative

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outcomes. Furthermore, learning deficits are costly in terms of expenses related to special education services and the personal suffering and frustration for children and families. Likewise, disruptive behavior problems contribute to loss of instruction time in the classroom (Arnold 1997), frustration for children and families, and considerable societal burden associated with antisocial acts, including delinquency and harm to others (Reid et al. 2002). Additionally, both behavioral and learning problems are quite refractory to typical interventions (see Hinshaw 1992b). Together academic and behavior problems are a significant public health burden, comprising major psychological, economic, and social problems.

Understanding and identifying the academic and behavioral characteristics associated with children at increased risk for these problems early in development can inform prevention and early intervention efforts, having a significant impact on the lives of children. Life course/social field theory maintains that early elementary school is a critical transition period that requires successful navigation of social task demands (e.g., making friends, learning classroom expectations, acquiring academic skills, complying with adult directions; Kellam & Rebok 1992). For many children, first grade is their first exposure to a full day away from their home environment. Failure to adapt to the academic and behavioral demands of first grade classroom sets the stage for additional problems in later development (e.g., adolescence and transition into middle school). Given the refractory nature of academic and behavior problems, identifying children struggling and intervening with either problem is particularly important early in their schooling experience.

Academic achievement difficulties and externalizing behavior problems co-occur at rates far greater than would be expected by chance, with estimates ranging from 10% to more than 50% (Hinshaw 1992b). This increased risk has been noted in both clinical (Frick et al. 1991) and epidemiological samples (Carroll et al. 2005; Rutter and Yule 1970). For instance, in the Isle of Wight epidemiological investigation, Rutter and Yule (1970) found that children with reading difficulties were four times more likely than the general population to display antisocial behavior. Replication of this study among children living in urban London (see Berger et al. 1975) found an even higher rate of co-occurrence, with nearly half of children having reading difficulties scoring above cutoffs for antisocial behavior on teacher ratings. A recent study (Bub et al. 2007) found that children exhibiting high levels of externalizing problems at 24 months of age had lower scores on achievement in first grade. Further, Heiervang et al. (2001) found that children with poor reading skills had more parent and teacher-reported aggressive behavior than children without reading problems. In addition, research indicates that youth with academic learning disabilities are described by parents as having more externalizing problems (Konstantareas and Homatidis 1989) and engage in violent behavior at twice the rate of youth not identified as having a learning problem (Svetaz et al. 2000).

One of the most common externalizing behavior problems associated with academic problems in youth is Attention Deficit Hyperactivity Disorder (ADHD). Estimates of the prevalence of ADHD from the general population range from approximately 2–18% (Rowland et al. 2002). Whereas the co-occurrence of ADHD and reading difficulties has been estimated at 15–45% (August and Garfinkel 1990), indicating increased risk for one problem with the presence of the other. Further, some studies suggest that the association between disruptive behavior problems and academic underachievement is largely explained by comorbid ADHD (Frick et al. 1991) Several studies indicate that attention problems, with or without hyperactivity, is the most salient risk factor for academic problems (Carroll et. al. 2005; Willcutt et al. 2000). In fact, Carroll et al. (2005) found that the association between academic problems and externalizing disorders was mediated by inattention alone. Therefore, in addition to disruptive behavior problems, inattention is an important

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behavioral variable to consider when investigating the co-occurrence between academic and behavior problems in children.

Further, achievement disparities between low-income African American children and other groups of children are well-documented in the U.S., and teachers are more likely to rate African American children as being more inattentive compared to White or Hispanic students (DuPaul et al. 1997). Understanding the relationship between inattention and academic underachievement, particularly with African American children, and the co-occurrence with externalizing problems could have important implication for prevention and intervention efforts.

Additionally, several studies have found evidence of gender differences in relation to the association between academic and behavior problems. For instance, Willcutt and Pennington (2000) found that both boys and girls with reading problems exhibited more aggressive and delinquent behaviors than youth without reading difficulties; however, they found that aggressive behaviors were more evident in boys than in girls. Similarly, Williams and McGee (1994) found that boys with academic problems were at increased risk for problems with conduct, whereas, Maughan et al. (1996) found that girls with academic problems were more likely to develop later behavioral problems. Moreover, girls, in general, are known to have a lower prevalence of disruptive behavior problems when compared to boys. However, the severity of disruptive behavior is typically higher for girls compared to boys when the probability of comorbid conditions is taken into account (Loeber and Keenan 1994). These findings suggest that it may be important to consider the effects of gender when investigating the co-occurrence between academic and behavior problems in children.

Research has typically focused on understanding the unidirectional causal relationship between academic and behavior problems, investigating whether early behavior problems precipitate later underachievement or if early underachievement leads to subsequent externalizing behavior (see Hinshaw 1992a for a review). The relationship, however, is complex and difficult to tease apart. To understand the underlying nature of co-occurrence between academic and behavior problems in children, research utilizing methods to identify subclasses of children based on the presentation of symptoms may yield additional insights. For instance, patterns of co-occurrence between academic problems and behavioral difficulties may be different between boys and girls. Further, the role of inattention may be more fully understood in the relation between externalizing behavior problems and academic problems when the characteristics are considered in combination. However, no studies to our knowledge have utilized these techniques when investigating these frequently co-occurring conditions. Thus, to better understand the specific behavioral and academic problem characteristics displayed by children, the present study used a person-centered latent variable approach to classify children into optimal grouping categories based on common symptom presentations (Muthén and Muthén 2000; Nylund et al. 2005).

Person-level methods, such as cluster analysis and latent class analysis (LCA), have advantages over variable-level analyses like regression and factor analysis (Walrath et al. 2004). Rather than grouping similar items and variables as in factor analysis, person-centered analyses provide a way of grouping individuals into classes based on shared characteristics that distinguish members of one class from another class. If these shared characteristics represent a range of well-defined subgroups, the resulting classification could characterize children by the nature and complexity of their symptom presentation. Further, the predictive validity of these subgroups can be tested by investigating their longitudinal association with negative academic and behavioral outcomes. This in turn, could provide important information toward identifying appropriate preventive and intervention strategies.

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Although cluster analysis has been the most commonly used person-centered method, it has several shortcomings including the lack a clear benchmarks or statistics for determining how well the solution fits the data. As such, the number of classes in cluster analysis is somewhat arbitrary (Yang et al. 2005; Vermunt and Magdison 2002). LCA, on the other hand, enables researchers to identify discrete *latent* variables that best group individuals based on their scores from two or more discrete observed variables (McCutcheon 1987). LCA uses categorical observed variables as indicator variables and is a multivariate approach that assumes an underlying latent variable that determines an individual's class membership. LCA was used in the study described below.

Unlike cluster analysis, LCA is model-based (i.e., the model can be replicated with an independent sample; Nylund et al. 2007). In LCA, the number of classes is determined through fit statistics and tests of significance. LCA assigns membership based on probabilities and thus is able to take uncertainty of membership, or error, into account; cluster analysis cannot. LCA is also more robust with regard to scaling differences on observed variables. LCA has outperformed cluster analyses in several Monte Carlo studies. Additionally, LCA affords the opportunity to include covariates and outcomes in models to determine how well specified groups predict outcomes and other demographic and diagnostic criteria (Walrath et al. 2004).

From a public health perspective, it is important to know who is at greatest risk for academic and behavior problems, and whether early indicators of these problems predict future problems. The first year of elementary school brings about a host of new social-emotional and educational challenges and is often a time at which academic and behavioral difficulties are evinced. Identifying children struggling with academic and behavior problems is particularly important at this stage in development (Kellam and Rebok 1992). Distal outcomes in sixth grade were identified to determine if early indicators of risk predicted problems later in development. Sixth grade outcomes were selected because it represents the transition from elementary to middle school. This transition can be challenging for many children. At this stage in development, children are provided more autonomy and the level of task demands increase, making sixth grade outcomes good indicators of overall adaptation.

In the present study, we conducted a LCA on the behavioral and academic characteristics of children in the fall of first grade. The goals were to: (a) determine the number and types of classes that best summarize the data, (b) compare the class characteristics for boys and girls, and (c) to investigate distal outcomes in sixth grade associated with class membership in the fall of first grade. We hypothesized that several subclasses of behavioral and academic characteristics of children would emerge, including a subgroup of children exhibiting primarily academic problems, a subgroup exhibiting primarily behavior problems, a subgroup with co-occurring behavioral and academic problems, and a subgroup of children exhibiting neither academic nor behavioral difficulties. Further, gender differences between the presentation of academic and behavioral problem characteristics were expected based on literature suggesting that gender may moderate the findings associated with the co-occurrence of academic and behavior problems. Lastly, the subgroups of behavior and academic problems were expected to predict long-term negative behavioral and academic outcomes assessed in the spring of sixth grade, with the co-occurring subgroup exhibiting the greatest risk for having negative distal outcomes.

The present study expands upon previous work in several important ways. First, unlike previous studies that have utilized small-scale samples of convenience (e.g., Frick et al. 1991) the sample used in this study is an epidemiologically defined sample representative of all students entering first grade in an urban area. Additionally, the sample is primarily

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African American and low income, a population typically understudied. Secondly, it is one of the first studies to utilize latent class analysis to understand the co-occurrence of academic and behavior problems in children. Lastly, distal outcomes at the transition to middle school were used to quantify the consequences of being in a particular problem class, providing vital information regarding potential targets for the prevention of academic and behavior problems in children.

Methods

Participants

Data were drawn from a longitudinal study conducted by the Prevention Intervention Research Center (PIRC) at Johns Hopkins University (JHU). The original study population consisted of a total of 678 children and families, representative of students entering first grade in nine Baltimore City public elementary schools. The children were recruited for participation in two school-based, preventive, intervention trials targeting early learning and aggression (Ialongo et al. 1999). Written informed consent was obtained from parents and verbal assent from the youth in accord with the requirements of the Johns Hopkins University Bloomberg School of Public Health Committee on Human Research. Three first grade classrooms in each of the nine elementary schools were randomly assigned to one of the two intervention conditions (classroom centered or family partnership intervention) or a control condition. The classroom centered intervention consisted of curricular enhancements and improved classroom behavior management practices. The family partnership intervention consisted of training for teachers and school mental health professionals in parent–school communication and partnership building, and a series of workshops for parents focused on parent–school collaboration in facilitating children's learning and behavior. The interventions were provided over the first grade year, following a pretest assessment in the early fall.

Of these 678 children enrolled in the study in first grade 53% were male, 86% were African-American, and 14% were White. Seventy-five percent of the sample (53% male; 88% African American, 12% White) completed the sixth grade outcome measures. Children who completed sixth grade assessments did not significantly differ from the children who did not on measures of teacher-rated inattention, aggression, and oppositional behavior, or on standardized academic achievement scores for reading or math collected during fall of first grade ($ps>0.05$). As an indicator of low socioeconomic status, 69% of the sample for the present study received free lunch or reduced lunches according to parent report in the fall of first grade. This percentage did not significantly differ for those who completed sixth grade assessments and those who did not ($p>0.05$).

Measures

Early aggressive behavior, oppositional behavior, attention problems, and academic problems associated with math and reading were used as indicators for academic and behavior problems in the fall of first grade. To test for the association of these first grade characteristics of academic and behavior problems with outcomes in the spring of sixth grade the following measures were utilized: (1) deviant peer affiliation, (2) teacher reported grades, (3) special education status, (4) suspensions from school, and (5) teacher reported conduct problems. All multi-item assessments, described in more detail below, were divided into binary items to indicate those children with the most problems (e. g., top 25% for aggressive behavior in sample, bottom 25% for reading) versus those children with fewer or no problems. Farrington and Loeber (2000) showed that dichotomizing explanatory variables in the Pittsburgh Youth Study yielded comparable strength of associations as continuous variables. They recommended using dichotomized variables when studying

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multiple risk factors, as in this case, because they produce realistic and meaningful measures of strength of relationship (e.g., odd ratios and relative risk) that can be easily understood by a wide audience (Farrington and Loeber 2000).

Predictor Measures Collected in Fall of First Grade

Early Behavior Problems—Teacher ratings of aggressive behavior, oppositional behavior, and attention problems were obtained in the fall semester of the first grade using the Teacher Observation of Classroom Adaptation-Revised (TOCA-R; Werthamer-Larsson et al. 1991). The TOCA-R was developed and employed by the JHU PIRC in the evaluation of the first and second generation JHU PIRC trials. The TOCA-R was developed using the following procedures: (1) elementary school teachers were interviewed to determine the behaviors that they required of students to be successful in school, (2) a pool of items, largely drawn from the DSM-III, III-R and IV, were then generated based on the teachers' responses, (3) a psychometric study of these items was carried out in 19 schools with 50 elementary school teachers and approximately 1,000 students, and 4) exploratory and confirmatory factor analyses were then carried out to determine the TOCA-R factor structure and sub-scales. The TOCA-R requires teachers to respond to 43-items pertaining to the child's adaptation to classroom task demands over the last 3 weeks. Adaptation is rated by teachers on a six-point frequency scale (1 = almost never to 6 = almost always).

The Aggressive/Disruptive Behavior subscale of the TOCA-R consists of 11 items (e.g., "fights," "harms or hurts others physically") and reported an alpha of 0.96 in fall and spring of first grade. In terms of concurrent validity, scores on the Aggressive/Disruptive behavior subscale were significantly related to the incidence of school suspensions within each year in elementary school (i.e., the higher the score on aggressive behavior, the greater the likelihood of being suspended from school that year) in the first generation JHU PIRC trial.

The Oppositional Behavior subscale of the TOCA-R consists of four items. These items are: (1) accepts responsibility for actions, (2) disobeys teacher or other adults, (3) talks back to teachers and other adults, and (4) breaks rules. Cronbach's alpha was 0.77 in fall and spring of first grade. In terms of concurrent validity, scores on the oppositional behavior subscale were significantly related to the incidence of school suspensions in elementary school (i.e., the higher the score on oppositional behavior, the greater the likelihood of being suspended from school that year).

The Attention-Concentration Problems subscale of the TOCA-R has nine items (e.g., "pays attention," "easily distracted") and reported an alpha of 0.91 in fall and spring of first grade. In terms of concurrent validity, each single unit of increase in teacher-rated attention/concentration problems was associated with a twofold increase in risk of teacher perception of the need for medication for such problems. In addition, for each unit increase in TOCA-R Attention/Concentration subscale scores in grade 1, there was just under a 60% increase in the likelihood of failing to graduate from high school. Although diagnoses were not used in the present study, teacher-ratings of inattention are considered the gold standard for identifying children with ADHD (Ostrander et al. 1998; Pelham et al. 2005; Powers et al. 1998). Inattention is normally distributed in the general population and diagnostic classifications are used more for convenience.

Early Academic Problems (Comprehensive Test of Basic Skills; CTBS)—The Comprehensive Test of Basic Skills 4 (CTBS; Fourth Edition, 1990). The CTBS represents one of the most frequently used standardized achievement batteries in the United States. Subtests on the CTBS cover both verbal (word analysis, visual recognition, vocabulary, comprehension, spelling, and language mechanics and expression) and quantitative topics (computation, concepts, and applications). The CTBS was standardized on a nationally

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representative sample of 323,000 children from kindergarten through grade 12. In the present study, the CTBS was administered during the fall of first grade. The CTBS Total Math and Reading scores for each child collected during the fall of first grade were used for all analyses.

Outcomes Measures Collected in Spring of Sixth Grade

Deviant Peer Affiliation—A subset of items from Capaldi and Patterson's (1989) youth self-report scale was used to measure deviant peer affiliation in the spring of sixth grade. Youth were asked to indicate how many of their friends (1 = none to 5 = all of them) engaged in antisocial behavior, such as hitting or threatening someone, stealing, and damaging other's property. The scale was the mean of seven items with higher scores indicating more deviant peer affiliation, reporting an alpha of 0.76.

Conduct Problems—The Conduct Problems subscale consists of 9 items from the Teacher Report of Classroom Behavior Checklist (TRCBC). The TRCBC is an adaptation of the TOCA-R; (Werthamer-Larsson et al. 1991) used in grades 1–3. In sixth grade, given that students have multiple teachers throughout the day, the child's language arts and mathematics teachers were asked to complete the TRCB. Like the TOCA-R, the items for the TRCBC were largely drawn from the DSM-III-R and IV, and scales were created that included items that represented the breadth of common maladaptive behaviors seen either in the child and/or adolescent years. The coefficient alphas for the conduct problems subscale for the TRCBC in middle school was 0.91. In terms of the concurrent validity of the TRCBC, the Conduct Problems subscale was significantly related to whether a child had been suspended from school during elementary and middle school.

Poor Grades—As part of the TRCBC, the child's language arts and mathematics teachers reported on the youth's grade in that class (excellent, good, fair, barely passing, or failing). The two reports were aggregated. For the purposes of these analyses this item was recoded as a dichotomous variable (1 = barely passing or failing; 0 = excellent to fair grades).

Special Education and School Suspension—School records were used to determine the presence or absence of special education services and school disciplinary removals in sixth grade for each child participating in the study. This information was obtained by electronic data file transfer, both with error and reliability checks.

Statistical Methods

Latent class analysis (LCA) was applied to examine the structure underlying the five indicators of academic and behavior problems in the fall of first grade. The basic premise of LCA is that within classes the behaviors are locally independent. In the case of this study, this means that the co-occurrence of academic and behavior problems can be explained by an underlying classification of children into subclasses with similar patterns of behavior. The goal of LCA is to identify the smallest number of classes that describes the association between the selected first grade indicators. The results for the characteristics for identified latent classes are expressed in probabilities of having high levels of academic or behavioral problems and the prevalence or proportion of children in each class.

Once the appropriate number of latent classes were determined, the classes were used to predict distal outcomes in sixth grade, utilizing latent class regression analysis (Guo et al. 2006). This allowed us to describe the association between the LCA-derived academic and behavior subclasses and distal outcomes. Each outcome was modeled separately. Results associated with sixth grade outcomes are presented in the form of odds ratios. Intervention status was included in all outcome analyses to control for any associated effects. The

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intervention main effects were in the expected direction, but not statistically significant at $p<.05$. The interaction between intervention status and fall of first grade latent class membership is the subject of a manuscript in preparation. The examination of such an interaction is consistent with the hypothesis that universal preventive interventions are most likely to benefit those individuals who exhibit some level of the targeted risk behaviors. In all analyses, standard errors were corrected to reflect that fact that children were clustered within classrooms (Reboussin et al. 2006).

Determining Model Fit—All analyses were conducted using MPlus 4.2 (Muthén and Muthén 2006). As in SEM, with latent class models, there are multiple statistical indictors of model fit. In LCA, a combination of statistical considerations and substantive theory are used to decide on the best fitting model. In our analyses, more weight was given to the Bayesian Information Criterion (BIC; Schwartz 1978) because recent simulation studies suggest it provides the most reliable indicators of true model fit (Nylund et al. 2007). Entropy is also used as an indicator of how well the model classifies people, where values closer to or exactly 1 indicate better classification. However, entropy should always be examined in conjunction with other model fit indices.

Treatment of Missing Data—The Mplus software uses a full information maximum likelihood estimation under the assumption that the data are missing at random (MAR; Arbuckle 1996; Little 1995), which is a widely accepted way of handling missing data (Muthén and Shedden 1999; Schafer and Graham 2002). All subjects were included in the analyses with none having to be removed due to missing data on the latent class indicators. The covariance coverage for all variables ranged from 0.715–1.0 for both genders, well above minimum thresholds for establishing adequate coverage (e.g.,.10; Muthén and Muthén 2006). The mixture missing command was used in all analyses to account for missing data.

Results

Latent Class Analysis (LCA) of Early Academic and Behavior Problems—We first conducted a LCA to determine the optimal number of classes and the academic and behavioral characteristics associated with each class. We included five indicators in these analyses: each child's rating during the fall of first grade on the TOCA-R for the Aggression, Oppositional, and Inattention subscales, and the reading and math subscales of the CTBS.

LCA fit indices for class solutions are summarized in Table 1 for boys and Table 2 for girls. For boys, the four class solution emerged as the optimal fit for the data as evidenced by the BIC, and Adjusted BIC. The four class solution yielded the lowest BIC and adjusted BIC values. For girls, the three class solution emerged as the optimal fit for the data. The three class solution yielded the lowest BIC and adjusted BIC values.

Characteristics of the Classes for Boys—Figure 1 summarizes the prevalence and characteristics of the four identified latent classes for boys. Probabilities of scoring in the poorest quartile on each TOCA-R subscale and academic indicator are given for each class. Class labels were assigned based on the overall pattern and presentation of behavior and academic problems for each class. Classes with multiple problems were labeled with descriptors that summarized the multiple problem presentation.

For boys, Class 1 characterized a subclass of children with both Academic and Behavior Problems (14% of boys). The children in this class had high probabilities for falling into the

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top quartile for aggressive behavior (0.96), oppositional behavior (0.76), and inattention (0.93), as well as having high probabilities of falling into the bottom quartile for reading (0.68) and math (0.85) skills. Class 2 was labeled as Academic Problems Only (11% of boys). Children in this subclass had high probabilities of falling into the bottom quartile for reading (0.77) and math (0.88), moderate probabilities for falling into the top quartile for inattention (0.55) and low to no probability of having aggressive (0.00) or oppositional behavior (0.04). Class 3, identified as a subclass of children with Behavior Problems only (16% of boys), had high probabilities for falling into the top quartile for aggressive behavior (0.77), oppositional behavior (0.81), moderate probabilities for falling into the top quartile for inattention (0.45), and low to no probability of having difficulties with reading (0.02) or math (0.00). Class 4, the No Problem class, indicating a normative group of children was the most prevalent class (59%) and was characterized by low probabilities for aggressive behavior (0.00), oppositional behavior (0.08), inattention (0.11), poor reading (0.16), and poor math (0.06).

Characteristics of the Classes for Girls—Figure 2 summarizes the prevalence and characteristic of the three identified classes of academic and behavior problems for girls. Similar to the boys, Class 1 was best characterized as the Academic and Behavior Problems Class (11% of girls) given that children in this class had high probabilities for falling into the top quartile for aggressive behavior (0.97), oppositional behavior (0.86), and inattention (0.77), as well as having moderate probabilities of falling into the bottom quartile for reading (0.51) and math (0.55) skills. Class 2 was labeled as Academic Problems Only (24% of girls). Girls in this subclass had high probabilities for falling into the bottom quartile for reading (0.71) and math (0.75), but low probabilities for falling into the highest quartile for inattention (0.35) and no probability of having aggressive or oppositional behavior. Class 3, the No Problem class, was the most prevalent class (65%) and was characterized by low probabilities for aggressive behavior (0.06), oppositional behavior (0.01), inattention (0.10), poor reading (0.04), and poor math (0.00).

The primary distinction between the subclasses identified for boys versus girls was the absence of a distinct class of girls with behavior problems only. Additionally, the prevalence for girls in the academic only subclass was two times that of girls in the academic and behavior problems subclass. Whereas, the prevalence's across the three problem subclasses for boys (i.e., co-occurring academic and behavior problems, academic problems only, and behavior problems only) were similar.

Predicting Sixth Grade Outcomes

Outcomes Associated with Each Class for Boys—Table 3 summarizes the odd ratios estimates (OR) for academic and behavior class membership in relation to sixth grade outcomes for boys as derived with longitudinal latent class multinomial logistic regression models. The OR indicates the estimated odds for each identified problem class (e.g., academic and behavior problem class) relative to the No Problem class. Boys in the Academic and Behavior Problem subclass were two times more likely to have poor or failing grades, 11 times more likely to received special education services, seven times more likely to be suspended from school, 11 times more likely to be rated as having high levels of conduct problems by their teachers, and were three times more likely to report affiliating with deviant peers than boys in the No Problem subclass. Boys in the Behavior Problem Only subclass were also found to have multiple negative outcomes in sixth grade, including being three times more likely to incur suspension from school and five times more likely to be rated as having high levels of conduct problems when compared to boys in the No Problem subclass. Boys in the Academic Problems Only subclass were not significantly different from boys in the No Problems subclass on the sixth grade outcomes of interest.

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Outcomes Associated with Each Class for Girls—Table 4 summarizes the odd ratios estimates (OR) for academic and behavior class membership in relation to sixth grade outcomes for girls as derived with longitudinal latent class multinomial logistic regression models. Girls in the Academic and Behavior Problems subclass were three times more likely to have poor or failing grades, 11 times more likely to receive special education services, and four times more likely to be rated as having high levels of conduct problems by their teachers in sixth grade when compared to girls in the No Problem subclass. Girls in the Academic Problems Only subclass shared similar outcomes to those in the Academic and Behavior Problem subclass. For instance, similar to those girls in the Academic and Behavior Problem subclass, girls in the Academic Problems Only subclass were three times more likely to have poor or failing grades than girls in the No Problem subclass. They were also 13 times more likely to receive special education services. The main difference between the two problem classes for girls was that the Academic Problems Only subclasses were not significantly different from the No Problem subclass of girls on teacher ratings of conduct problems.

Discussion

The aim of this study was to identify classes of academic and behavior problems at entry into first grade for a high risk population of predominantly African American children. Results supported the hypotheses that multiple subclasses of children would be identified, including a class with co-occurring academic and behavior problems. Additionally, gender differences were found in relation to the number of identified classes and the characteristics of academic and behavior problems for children. For instance, the four hypothesized subgroups of children were found for boys (e.g., co-occurring academic and behavior problems, academic problems only, behavior problems only, and a class with no academic or behavior problems). However, girls were not characterized by a behavior problems only subclass. That is, behavior problems in girls only occurred in combination with academic problems.

Additionally, the study investigated to what extent identified subclasses of behavioral and academic difficulties placed these children at risk for future problems. Consistent with life course/social field theory, several of the classes for children, particularly the co-occurring academic and behavior problems subclass for both genders, predicted negative long-term outcomes in sixth grade, including academic failure, receipt of special education services, and elevated risk for conduct problems. The finding that subclasses of academic and behavior problems predict negative outcomes occurring over 5 years later corroborates the importance of the identified classes and the need to target interventions for children presenting with the associated class characteristics.

The findings from this study have implications for early identification, prevention, and intervention for children at risk for academic failure and disruptive behavior problems. For instance, these findings suggest that there is a distinct class of children who present with both academic and behavior problems as early as entry into first grade. In fact, the combined prevalence of these co-occurring problems across boys and girls was 12.5%. Thus, a fair number of children from this high risk sample entered first grade with a combination of academic and behavioral difficulties. Given that both academic and behavior problems become increasingly intractable to intervention over time, intervening early in development appears crucial for averting negative outcomes. For girls, given that a Behavior Problems Only subclass was not identified, the findings suggest that the presence of behavior problems at school entry should alert school personnel of the possibility of co-occurring academic problems, and vice versa. Coordinating and combining interventions across both problems areas could lead to optimal outcomes for both girls and boys.

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Early screening could be an important asset to allowing for coordination of services across problem areas. Many schools already routinely administer academic screeners to help identify children at risk for academic problems. For instance, in union with the national *Reading First* initiative (U.S. Department of Education 2002), curriculum based assessment measures are widely used at the elementary level (e.g., Dynamic Indicators of Basic Early Literacy; DIBELS, see Good et al. 2001 for a review). These measures are standardized individually administered measures used to regularly monitor the development of pre-academic skills. Given that schools are already routinely administering these academic measures, behavioral assessments could be incorporated and administered with students showing risk of academic problems or across all students to help identify children in need of additional behavioral supports. This form of early screening, particularly in schools working with high risk populations, could allow schools to target children and provide early intervention services based on their academic and behavioral needs.

Tailoring early intervention efforts to the needs of children based on screening and assessment measures could lead to effective treatment. Effective treatments will almost certainly vary based on identified class characteristics. A treatment targeting academic problems may be most effective for children presenting with no behavior problems whereas adjunctive treatments may be needed to address co-occurring academic problems and problems with inattention, aggression, and oppositional behavior. However, too often academic problems and behavioral problems are treated as separate entities. Treatment services, if provided, are not typically coordinated across providers or problem domains (Hinshaw 1992b). The growing popularity of modular approaches within the field of psychology has undoubtedly emerged from similar observations about the high rate of comorbid psychopathology made by other researchers and clinicians. The present study may provide guidance to future efforts to develop effective modular approaches to treating academic and behavior problem areas in children. In particular, the findings suggest that future innovations in modular or stand-only treatments for disruptive behavior problems are needed to target the presence of inattentive and the academic problems that were so prevalent in the identified classes.

The probability of children exhibiting inattention across the combined problem subclasses for both genders was much higher than for children in the No Problem subclass. Additionally, the Academic Problems Only subclass for girls was also characterized by attention problems. Therefore, children exhibiting high levels of inattention may be at risk for academic problems, behavior problems, or both. The increased likelihood of children in most risk classes to exhibit problems with attention is important when devising interventions. For instance, there is considerable evidence for the benefits of stimulant medication in improving academic productivity and accuracy for students diagnosed with ADHD. However, medication may not improve academic performance (Rapport et al. 1994), is frequently not sufficient to address academic impairments (DuPaul and Stoner 2003), might not be tolerated by some children, and may not be considered an acceptable intervention option by parents. Thus, nonpharmacological interventions to enhance academic success are also needed for students with problems of attention. Contingency management programs (e.g., token economy systems, response cost, daily report cards) have been found to benefit children exhibiting symptoms of inattention and disruptive behavior. However, these approaches appear to be more effective in modifying behavior than in enhancing academic performance (DuPaul and Eckert 1997). Therefore, thoughtful consideration is necessary, and should be based on the academic and behavioral characteristics of the child, when designing appropriate interventions exhibiting problems with inattention.

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It is also important to note that the Academic Problems Only subclass for boys was not associated with attention problems. For boys in this sample, attention problems always co-occurred with behavior problems (with or without academic problems). Thus, there was a cluster of boys (11%) whose academic difficulties were not tied to behavior or attention problems who may benefit from pure academic interventions such as small group instruction, double dosing math and reading instruction, and progress monitoring.

Similarly, these findings support the need for prevention programs that target the emergence of the co-occurring problems of disruptive behavior and academic underachievement early in development. Several trials during the past decade have targeted multiple problem areas and included integrated interventions for home, school, and peer environments (August et al. 2001; Conduct Problems Prevention Research Group 1999). However, even in these progressive trials, behavior problems are emphasized in both defining risk and in the targeted interventions. For instance, although these trials included a school component, they offered limited academic interventions for children (usually in the form of tutoring). Children with academic skill deficits likely need moderate to intensive academic interventions comparable to the intensive interventions that are offered for their behavior problems.

Research that targets and prevents problem co-occurrence with comprehensive coordinated programs that incorporate academic and behavioral interventions across multiple environments, including school and family settings are needed. If we are to truly impact outcomes associated with the often difficult to treat problems of academic and behavior problems linking prevention and treatment that allow for generalization across the setting would likely derive the greatest benefit. One strategy may include mobilizing efforts through universal prevention of academic and behavioral problems in school in combination with secondary and tertiary intervention that focus on intensive academic programming, teacher consultation, parent training, and family therapy.

The primary strengths of this study include the use of an innovative, model-based clustering procedure called latent class analysis that allowed for the detection of sub-populations based on observed patterns of academic and behavior problems early in development and as well as the use of a prospective longitudinal design, permitting for the investigation of long-term outcomes associated with problem subclasses into middle school. The fact that several of the problem subclasses were predictive of long-term negative academic and behavioral consequences in sixth grade adds prognostic validity to the subclasses. Additionally, the study relied on a large sample of predominantly low-income African American children living in an urban setting, making the implications for prevention and intervention design sensitive to this understudied population. Findings can inform the development of future preventive interventions that target the needs of this high risk group.

The present study is not without limitations. It provided only a snapshot of participants' academic and behavioral patterns at a single point in time; the onset of symptom co-occurrence for this sample is unknown (e.g., did the symptoms start simultaneously or did one or more symptom clusters precede the others). Although some research to date has examined this question, the present findings suggest the need for more sophisticated theories and methodologies.

Future studies utilizing longitudinal epidemiologic samples investigating the timing and co-occurrence of academic and behavior problems would be beneficial. In this regard emerging statistical technologies are needed to understand and describe the growth of common symptom patterns. One analytic technique, not commonly used to date, called latent transition analyses (LTA), may be particularly useful (Nylund et al. 2005). LTA allows

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researchers to model the probability of moving from earlier defined classes (e.g., behavior problems only class) to later classes (e.g., academic and behavior problems class) across different periods of development. As such, LTA allows researchers to define common comorbidities at different stages and model movement in and out of these classes over time.

Additionally, replication of this LCA with other community, epidemiological samples is needed to provide further evidence of the validity of these classes. Additionally, although class indicators for academic problems were assessed by an independent measure (i.e., standardized achievement test), behavioral symptom patterns were based solely on teacher ratings. These ratings were from a single informant and likely best characterize the children's' behavior in one primary setting, school. It would be useful to replicate the study with other informants (e.g., parents) to see if the behaviors and classes are consistent across settings and raters.

The prevalence of co-occurring problems as early as fall of first grade raises the question of what influences are in effect prior to the onset of schooling. The factors likely include a host of social, familial, and neurobehavioral variables that may culminate in the problem co-occurrence.

Thus, the complexity of the causal mechanisms underlying the association between academic and behavior problems calls for early intervention and prevention efforts that are comprehensive enough to handle the diversity of such factors. Evidence that the classes uniquely predict treatment response to different interventions will not only help validate the classes but also will guide intervention selection depending on child symptom presentation.

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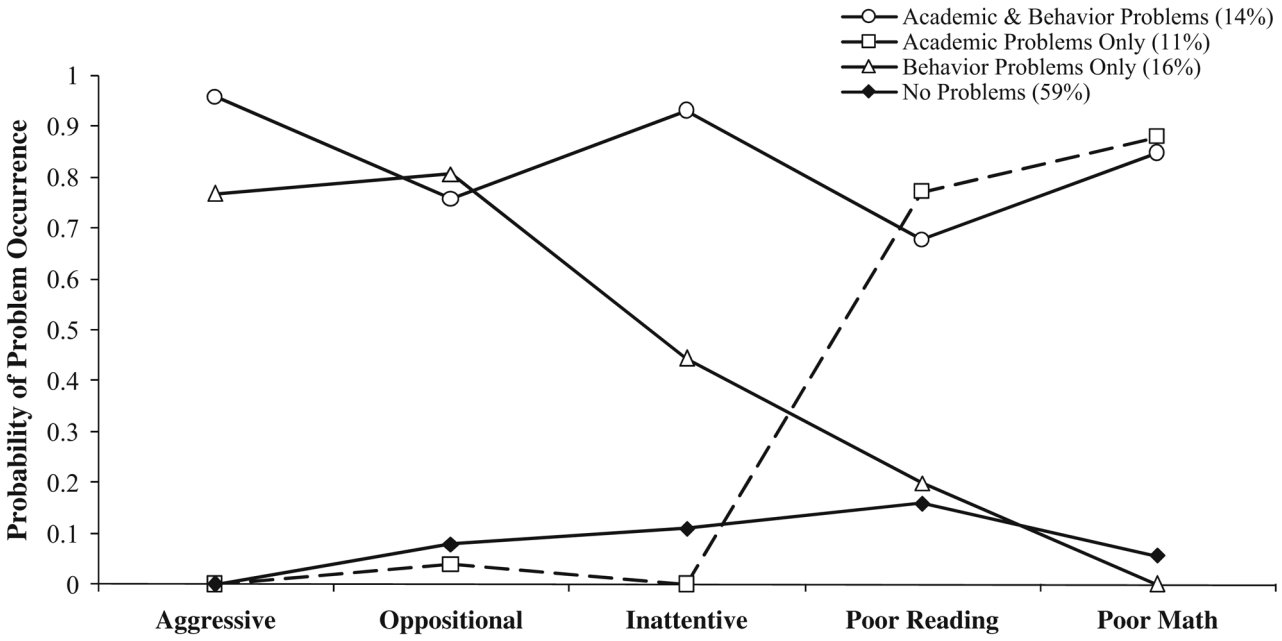

Fig. 1.
Defining characteristics and prevalence of each class at baseline for boys

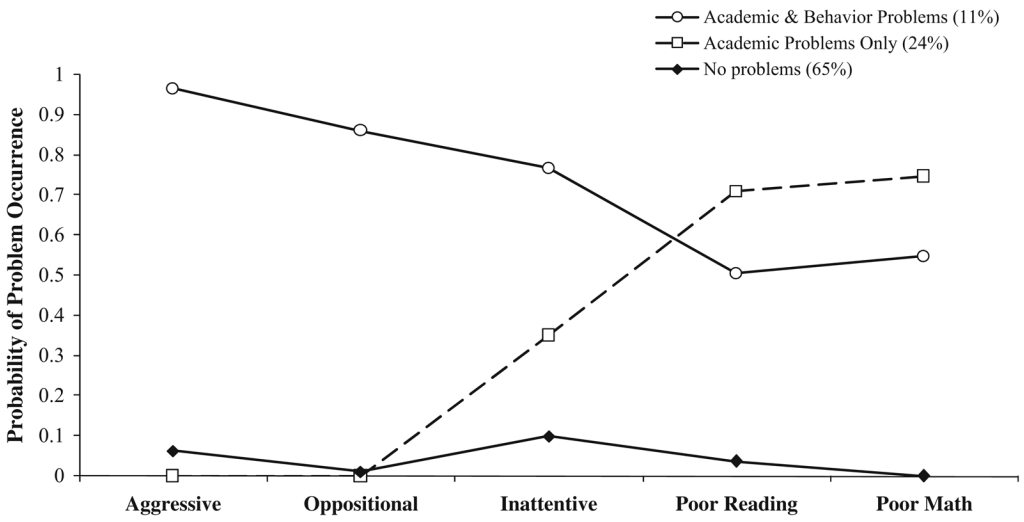

Fig. 2.
Defining characteristics and prevalence of each class at baseline for girls

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Table 1

Model fit indices for 1–5 class solutions of academic and behavior problems for boys

	BIC	Adj BIC	Entropy
1 class solution	2,128.790	2,112.928	–
2 class solution	1,931.917	1,897.019	0.835
3 class solution	1,889.770	1,835.837	0.857
4 class solution	**1,881.188**	**1,808.220**	**0.820**
5 class solution	1,910.248	1,818.244	0.837

Bold indicates best fit: lowest BIC and adjusted BIC indicate better fit. All entropy ratings indicate acceptable fit.

N=362

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Table 2

Model fit indices for 1–5 class solutions of academic and behavior problems for girls

	BIC	Adj BIC	Entropy
1 class solution	1,502.190	1,486.331	–
2 class solution	1,361.737	1,326.848	0.745
3 class solution	**1,293.743**	**1,239.824**	**0.860**
4 class solution	1,313.548	1,240.597	0.876

Bold indicates best fit: lowest BIC and adjusted BIC indicate better fit. All entropy ratings indicate acceptable fit.

N=316

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Table 3

Association between probability of class membership and sixth grade outcomes for boys

	Academic and behavior problems vs. No problem class	Academic problems only vs no problem class	Behavior problems only vs no problem class
Poor grades	2.36 (1.07–5.23) *	1.80 (0.88–3.69)	1.72 (0.76–3.90)
Special education	11.31 (1.92–66.69) *	5.21 (0.39–69.27)	4.64 (0.46–46.57)
Suspended from School	6.57 (2.04–21.20) *	1.15 (0.40–3.30)	3.42 (1.36–8.58) *
Conduct problems	11.21 (4.22–29.84) *	2.05 (0.75–5.60)	4.63 (1.33–16.15) *
Deviant peer affiliation	2.46 (1.19–5.09) *	0.90 (0.36–2.26)	0.94 (0.32–2.77)

All associations are given as odds ratios. Range indicates 95% confidence interval for odd ratios.

* $p<.05$.

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Table 4

Association between probability of class membership and sixth grade outcomes for girls

	Academic and behavior problems vs no problem class	Academic problems only vs no problem class
Poor grades	3.13 (1.17–8.38) *	3.30 (1.13–9.66) *
Special education	10.99 (3.78–32.01) *	12.59 (3.77–31.82) *
Suspended from school	1.80 (0.91–1.25)	0.65 (0.20–2.13)
Conduct problems	3.70 (1.17–11.66) *	1.57 (0.32–7.64)
Deviant peer affiliation	0.79 (0.30–2.08)	2.20 (0.83–5.83)

All associations are given as odds ratios. Range indicates 95% confidence interval for odd ratios.

* $p<0.05$.