

Emergent growth patterns of early education self-control problems among children from underresourced American families[☆]

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ABSTRACT

This research examined the latent developmental patterns for early classroom self-control problems among children from the nation's most underresourced families. Based on standardized teacher observations from the Head Start Impact Study, a nationally representative sample of children ($N=3827$) was assessed for manifestations of aggressive and attention seeking behavior over four years spanning prekindergarten through first grade. For each form of self-control problem, latent growth mixture modeling revealed distinct subpopulations of change patterns. Although most children improved over time, some children arrived in prekindergarten with moderate levels of aggression that remained relatively stable throughout the early transition years. Alternatively, some children early manifested more noticeable levels of either aggressive or attention seeking behaviors that increased in severity as they left prekindergarten. These latter subpopulations were associated with child gender, ethnicity, use of English as a secondary language, provision of special needs services, and maternal education. They were also more likely to experience academic difficulties and parent-reported problem behaviors and less likely to manifest positive relationships with teachers by the close of first grade. Decision rules are suggested for early assessments of children and recommendations made for future exploratory research.

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1. Introduction

A large body of interdisciplinary research has argued that all manifestations of childhood acting-out behavior, whether found in community populations (overt or covert aggression, reactive aggression, deficits in self-regulation or executive functioning) or clinical populations (attention-deficit disorder, oppositional disorder), can be parsimoniously viewed as *self-control* problems (Blair, 2016; Daly, Delaney, Egan, & Baumeister, 2015; Gagne, 2017; Kelley, Wagner, & Heatherton, 2015; Moffitt et al., 2011; Vazsonyi & Huang, 2010). Self-control is a complex “umbrella construct that bridges concepts and measurements from different scientific disciplines” (Moffitt, Poulton, & Caspi, 2013, p. 354). In fact, more than

a dozen terms (e.g., self-regulation, effortful control, cognitive control, executive function, etc.) have been used in multiple disciplines to describe some aspect of self-control (Nigg, 2017).

1.1. Self-control

In the developmental sciences, self-control is thought to be rooted in constitutional individual differences in regulation and reactivity called temperament (Posner, Rothbart, & Rueda, 2015; Rothbart, 2007). Three broad interrelated and hierarchically organized dimensions of temperament have been identified: (a) extraversion relating to positive affect and activity level; (b) negative emotionality with irritability; and (c) effortful control consisting of the ability to shift and focus attention as well as inhibit inappropriate behavior (Janson & Mathiesen, 2008; Rothbart, 2007). Extraversion and negative emotionality are reactive ‘bottom-up’ or ‘hot’ processes that develop early in life, whereas effortful control is a deliberate ‘top-down’ or ‘cold’ process that appears in the second year of life and rapidly develops across the toddlerhood and preschool years (Gagne, 2017; Nigg, 2017; Rothbart, Sheese, & Posner, 2007). With development, bottom-up

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and top-down processes operate in parallel, allowing self-control to encompass regulation of both behavior and emotion (Blair, 2016; Chester, 2017; Eisenberg, Spinrad, & Eggum, 2010; Feng, Hooper, & Jia, 2017; Liew, 2012; Rothbart et al., 2007).

Compelling evidence shows that emotional and behavioral self-control are strongly connected to overall life success and well-being (Moffitt et al., 2011, 2013) and that self-control deficits in childhood often portend later socioeconomic instability, antisociality, and even criminality (de Ridder, Lensvelt-Mulders, Finkenauer, Stok, & Baumeister, 2012; Falk et al., 2014; Huesmann, Dubow, & Boxer, 2009; Katsiyannis, Thompson, Barrett, & Kingree, 2013; Moffitt et al., 2011). Indeed, early self-control problems have been found to predict such outcomes with about the same accuracy as do early variations in cognitive ability and social stress, and the predictions maintain even when controlled for children's general intelligence, family dynamics, and household income levels (Meldrum, Petkovsek, Boutwell, & Young, 2017; Moffitt et al., 2011; Tremblay, 2010).

Self-control problems are particularly erosive in the context of schooling (Eisenberg, Valiente, & Eggum, 2010; Gestsdottir et al., 2014). A child's self-regulation is inextricably linked to the requisite capacities to focus and sustain attention, to delay first impulses and consider alternative behaviors, to appreciate teacher authority and instruction, and to observe personal and property rights of others. Failure to do so is ordinarily associated with poor short- and long-term social-emotional adjustment, academic proficiency, and school attendance and completion (Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013; Duckworth & Carlson, 2013; Lonigan, Allan, & Phillips, 2017; McDermott, Rikoon, & Fantuzzo, 2014, 2016). Moreover, a given child's self-control problems often tend to upset the educational experience for other learners and the teachers, as well as the focal child (Gottfried, 2014).

Because "self-control facilitates both the inhibition of undesirable behavior and the promotion of desirable behavior" (de Ridder et al., 2012, p. 78), children with low self-control "often have difficulty inhibiting inappropriate behaviors, willfully shifting attention toward important tasks, and focusing attention when necessary" (Wang, Chassin, Eisenberg, & Spinrad, 2015, p. 1825; Wang et al., 2015; Wang, Chassin, Eisenberg, & Spinrad, 2015, p. 1825). That is, they are unable to control their behavior or properly pay attention (Liew, 2012). These behaviors are described phenomenologically as either *aggressive* or *attention seeking* in nature. Specifically, aggression is defined as a construct constellation of phenotypically similar behaviors characterized by hostility or physical violence, belligerent language or attitudes, theft or destruction of property, and provocative or impulsive actions likely intended to control or dominate others. The attention seeking construct encompasses behavioral manifestations of inapt or misdirected attention control, characterized by intrusive, manipulative, and disruptive activity where the child's manifest attitudes are inclined to be overly self-centered, and actions are designed to gain the notice or favor of others. Violation of personal and property rights of others typifies aggressive self-control problems, whereas the inapt focus or shifting of attention are emblematic of attention seeking behaviors (Gray, Dueck, Rogers, & Tannock, 2017; Hay, 2017; McDermott, Watkins, Rovine, & Rikoon, 2013; Tremblay, 2010).

Aggressive self-control problems may differ from attention seeking self-control problems in early precursors, moderators, developmental growth trajectories, or responsiveness to intervention (de Ridder et al., 2012). For example, parental interventions during early childhood may have differential effects depending on initial self-control levels (Doyle, McGlanaghy, O'Farrelly, & Tremblay, 2016), self-control deficits may be moderated by early risk factors or distal outcomes (Barker & Maughan, 2009; Barker, Oliver, & Maughan, 2010; Duckworth, Quinn, & Tsukayanna, 2012; Tremblay, 2010), or the growth of self-control problems may be

disparately influenced by peers (Henneberger, Coffman, & Gest, 2017). Thus, it is important to separately consider attentional and aggressive self-control trajectories.

1.1.1. Aggression

Considerable evidence from longitudinal cohorts exists to indicate that many children exhibit aggressive self-control behaviors in early childhood but only a small percentage persist from childhood into adolescence (Barker et al., 2010; Barker & Maughan, 2009; Campbell, Spieker, Burchinal, Poe, & the NICHD Early Child Care Research Network, 2006; Carbonneau, Boivin, Brendgen, Nagin, & Tremblay, 2016; Côté, Vaillancourt, Barker, Nagin, & Tremblay, 2007; Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006; Kjeldsen, Janson, Stoolmiller, Torgersen, & Mathiesen, 2014; Nagin, & Tremblay, 2016; NICHD Early Child Care Research Network, 2004; Tremblay, 2010; Tremblay et al., 2004; Vazonyi & Huang, 2010). When examined across the preschool years among non-clinical samples, three developmental trajectories are often detected (Wildeboer et al., 2015). For example, trajectories of very low (31.5%), moderate (52.5%), and high (16%) aggression were identified within a Canadian birth cohort of 2045 children that was longitudinally studied from age 1.5 to 5 years of age (Carbonneau et al., 2016). Studies that track children into elementary school often find that some of the children with early aggressive behaviors became less aggressive by middle childhood. For instance, a Canadian population-based longitudinal study of 13,439 children from age 2 years to 8 years (Côté et al., 2007) found four aggression trajectories: (a) low and stable, 5%; (b) high and stable, 15%; (c) low and decreasing, 36%; and (d) moderate but decreasing, 44%. When extended to adolescence, it is often discovered that some children's trajectories decrease after childhood whereas others increase at adolescence. For instance, a Norwegian population-based longitudinal study (Kjeldsen et al., 2014) followed 921 children from birth through 14.5 years and found five trajectories: (a) high and stable, 18%; (b) high but limited to childhood, 5%; (c) medium but limited to childhood, 31%; (d) adolescent onset, 30%; and (e) low and stable, 16%.

Taken altogether, it appears that the developmental trajectory of aggression mirrors the developmental taxonomy of antisocial behavior described by Moffitt (1993). Specifically, distinct categories of individual children exist, where a large group exhibits low levels of aggressive self-control problems, a second smaller group exhibits fluctuating levels of aggressive self-control problems, and a third even smaller group exhibits persistently high levels of aggressive self-control problems. Membership in the persistently aggressive group forecasts future educational and psychosocial difficulties (Álvarez-García, García, & Núñez, 2015; Barker & Maughan, 2009; Campbell et al., 2006; Côté et al., 2007; Hay, 2017; Wildeboer et al., 2015). For example, a recent meta-analysis of psychosocial outcome research found that early onset persistently aggressive groups had poorer mental health, greater alcohol use, increased aggression, more extensive criminal records, impaired educational performance, and reduced occupational success in adulthood (Bevilacqua, Hale, Barker, & Viner, 2018).

Early risk factors for children with poor self-control of aggression consistently included sex (boys at greater risk) and often included race/ethnicity (African-American children at greater risk) but other risk factors (e.g., maternal, family, and child characteristics) have been inconsistently taken into account or detected (Kaufman et al., 2010; Vazonyi & Keiley, 2007; Tremblay, 2010).

1.1.2. Attention

Unfortunately, there has been little theoretical speculation about the developmental course of attentional control and most research has focused on attention-inattention rather than attention seeking. Although attention seeking and attention-inattention

both involve the inapt focus or shifting of attention, attention seeking behaviors aim to gain the notice or favor of others. Given the absence of theory and research on attention seeking, theories on the development of attention-deficit/hyperactivity disorder (ADHD) might come the closest because they combine inattentiveness with hyperactivity and impulsivity. [Barkley \(1997\)](#) suggested that sustained attention can be regulated by environmental and contextual contingencies or by poor inhibition that subsequently takes a toll on the self-regulation of attention. In the latter case, inattention should become more severe as the environmental demands increase. However, [Barkley \(1997\)](#) considered the development of focused or selective attention to differ from the development of sustained attention so it is difficult to arrive at strong theoretical predictions about self-control of attention among preschool children.

Further, attentional control has received less research attention than aggression control and has often been studied among high-risk or clinical populations (especially ADHD) rather than among population-based cohorts. Much of this research has failed to differentiate between inattention and hyperactivity although structural validity studies have consistently demonstrated that symptoms of inattention and hyperactivity can be differentiated in both clinical and typically developing samples ([DuPaul et al., 2016](#); [Toplak et al., 2012](#)). When attention problems were separately studied in these populations, three developmental trajectories appeared across the elementary school years: (a) low but slightly increasing, 14.8%; (b) moderate, 37.7%; and (c) high but decreasing, 47.5% ([Arnold et al., 2014](#)).

Regrettably, studies of non-clinical samples have applied designs that did not allow the detection of interindividual (between-person) differences in intraindividual (within-person) change or sampled children who were not representative of the typical child population ([Sterba & Bauer, 2010](#)). For example, attention was measured (albeit with a single survey item) for 2695 children at ages 7 and 18 years in a Greek birth cohort study. Inattention was observed to decrease from 9.5% to 7.3% of the sample across that 11-year span ([Palili et al., 2011](#)). Other studies focused on distal outcomes and did not elucidate developmental trajectories. For example, inattention was found to be a strong predictor of later academic difficulties among two large British prospective samples across elementary and secondary school years ([Merrell, Sayal, Tymms, & Kasim, 2017](#); [Sayal, Washbrook, & Propper, 2015](#)).

Only a few studies have applied person-oriented methods that allowed analysis of both within-person and between-person change over time. One study included data from 2,120 children born in Quebec, Canada that were followed from age 1.5 years to 10 years of age ([Salla et al., 2016](#)). Three developmental trajectories were identified for these children when their attention problems were measured at ages 6–10: (a) high, 2.5%; (b) moderate, 71.9%; and low, 25.6%. Likewise, three developmental trajectories of attention problems (low, 71%; low but increasing, 15%; and high but decreasing, 20%) were found among a large sample of twins from the Netherlands whose attention problems were measured at ages 6–12 years ([Robbers et al., 2011](#)). A subsequent analysis of the Quebec sample ([Salla et al., 2016](#)) that spanned elementary and high school years also detected three developmental profiles of inattention: (a) stable, 50.1%; (b) fluctuating, 25.7%; and (c) increasing, 24.1% ([Pingault et al., 2014](#)). In contrast, a study that included a large sample of Swedish twins aged 8–17 years detected only two developmental inattention trajectories: (a) low, 86%; and (b) high and increasing, 14% ([Larsson, Dilshad, Lichtenstein, & Barker, 2011](#)). Thus, the trajectory of inattention among young children is not well established. There have been no longitudinal studies that applied person-oriented methods to preschool children whereas those that focused on middle childhood through adolescence detected either two or three developmental trajectories.

However, inapt attentional control has both immediate and long-term consequences. At the preschool level, inattention is negatively related to prereading skills ([Dittman, 2016](#)). This suggests that attention problems may compromise reading development across the school-age years in a developmental cascade. The supposition that early inattentiveness will adversely affect later adjustment and academic attainment has been supported by research with clinical, at-risk, and typically developing children ([Carbonneau et al., 2016](#); [Duckworth et al., 2012](#); [Gray, Carter, Briggs-Gowan, Jones, & Wagmiller, 2014](#); [Gray et al., 2017](#); [Greven, Rijdsdijk, Asherson, & Plomin, 2012](#); [Pingault et al., 2013, 2014](#); [Polderman, Boomsma, Bartels, Verhulst, & Huizink, 2010](#); [Rabiner, Coie, & the Conduct Problems Prevention Research Group, 2000](#); [Salla et al., 2016](#)). As with aggressive self-control, most research has found that boys exhibit poorer attentional self-control than girls ([Arnett, Pennington, Willcutt, DeFries, & Olson, 2015](#); [Arnold et al., 2014](#); [DuPaul et al., 2016](#); [Larsson et al., 2011](#); [Merrell et al., 2017](#); [Palili et al., 2011](#); [Pingault et al., 2014](#); [Robbers et al., 2011](#); [Salla et al., 2016](#); [Sayal et al., 2015](#)).

Our study focuses on differential growth patterns of both aggressive and attention seeking self-control problems observed on a nationwide basis as children move through the prekindergarten years, and on into kindergarten and first grade (the early education transition years). The focus of our study sharpens further by concentrating on that segment of the early childhood population that is probably at greatest risk; specifically, those who arrive in prekindergarten from economically underresourced homes and socially stressed communities ([U.S. Department of Health and Human Services \[DHHS\], 2010a](#); [Isenberg et al., 2016](#)). The challenges facing such children are daunting from the outset, considering that the average Head Start enrollee is performing at the 15th to 20th percentile in areas of literacy, language, and mathematics ([DHHS, 2003](#); [Kopack Klein, Aikens, West, Lukashanets, & Tarullo, 2013](#)). Further, these children, partly related to a dearth of strong social support networks (related to impoverishment, large proportions of new immigrants, English-language limitations, etc.), face high risk for continued academic and socioemotional stress ([DHHS, 2010b](#); [Isenberg et al., 2016](#)).

1.2. Research hypotheses

Within this context, this study tested three hypotheses. First, we hypothesized the existence of at least two or three latent longitudinal subpopulations (distinctive growth trajectories) for both emergent aggressive and attention seeking behavior as children transition through preschool, kindergarten, and first grade. Second, we hypothesized that these distinctive growth subpopulations would associate with independent observations of classroom and home adjustment and with academic achievement (distal outcomes) at the close of first grade. Finally, we hypothesized that antecedent demographic and education-related variables (child sex, ethnicity, use of English as a secondary language, use of special needs services, maternal education) would predict the relative risk of child membership in the subpopulations of emergent self-control problems.

2. Method

2.1. Participants

The Head Start Impact Study ([HSIS]; [DHHS, 2010b](#)) was a nationwide American randomized field investigation designed to estimate the relative effectiveness of Head Start and comparable prekindergarten programs. Participant children were drawn randomly from 223 prekindergarten agencies across all U.S. geographic

regions, conditioned on a child's Head Start enrollment eligibility (a family income below or close to the federal poverty criterion). Children were thereafter permitted on a random basis to enroll in Head Start or another prekindergarten program, the youngest children having enrolled in academic year 2002–2003 (AY0203) and continuing in the study until AY0506. The primary classroom teachers assessed each child's behavioral adjustment at the end of the first year of prekindergarten (PreK 1), second prekindergarten year (PreK 2), kindergarten year (K), and first-grade year (1st grade).

Because not all children randomly selected for prekindergarten enrollment actually entered school for PreK 1, and because others did not enter prekindergarten settings that would provide a teacher and/or classroom-type environs and other children were not enrolled until later academic levels when it became compulsory, the national sample size increased as children moved from PreK 1 to 1st grade (i.e., PreK 1 $N = 1377$, PreK 2 $N = 2764$, K $N = 2873$, 1st grade $N = 3077$). As discussed below, sample accretion and attrition were unrelated to children's measured aggression or attention seeking, the outcome variables of interest.

The full national sample assessed in this study contained 3827 children, where mean age at entry to the study was 4.0 years ($SD = 0.5$), with 49.6% of children being females, 37.8% Hispanic, 29.5% African American, 32.7% White or other race/ethnicity, 25.7% primarily Spanish-speaking at entry, 12.8% identified with special needs, and 82.7% residing in urban areas. During PreK 1, children attended 540 preschool centers (867 different classrooms) and during PreK 2 1032 centers (1815 classrooms), while during K, children attended 1469 schools (2280 classrooms) and during 1st grade 1617 schools (2576 classrooms). During PreK years, approximately 80% of classrooms were not affiliated with conventional schools, with about 90% of post-PreK classrooms affiliated with public schools.

As determined by trained research technicians at the opening of AY0203, 50.3% of children lived with both biological parents, with 45.3% of mothers married (including remarried), 38.9% never married, and 15.8% currently separated or divorced. Additionally, 83.7% of mothers were adults at the time of their child's birth, with 20.0% being recent immigrants. Approximately 30.1% of mothers had not completed high school, while 33.3% had earned a high school credential, and 28.6% had finished schooling beyond high school. Based on the overall demographic picture, the participant child sample was regarded at relative risk for serious social and academic problems (Federal Interagency Forum on Child and Family Statistics, 2008; Huston & Bentley, 2010).

Characteristics of participant teachers were reported from a 2003 survey that framed statistics as they related to the sample of participant children attending Head Start or non-Head Start centers (Research Connections, 2003). At that time, 97.1% of children had female teachers, 24.0% had teachers who were Latino, 47.2% White, and 31.0% African-American. On average, children had teachers who had been teaching for 13.0 years ($SD = 8.8$). Approximately 31.5% of children had teachers with an associate's degree and 37.3% a bachelor's degree or higher, 45.7% a state teaching certificate, 60.9% a degree in early childhood or related field, and 52.9% a child development associate (CDA) credential.

2.2. Measures

In the current research, the degree or intensity of both the aggression and attention seeking phenomena are defined through their pervasive emergence across many different contexts within a given setting (e.g., multiple different situations across the classroom setting) rather than by a global or non-contextualized impression or from an isolated context (e.g., occurrence in a limited classroom situation, such as when answering questions). This perspective subscribes to the theoretical premise that consequen-

tial problem behaviors must be pervasive across contexts so as to inform the motivations underpinning the problems (Bulotsky-Shearer, Bell, & Domínguez, 2012; Mischel, 2004; Neugebauer, 2014; Shaffer & Postlethwaite, 2012) and to avoid the misperception that problems observed in limited contexts are indicative of problems in general (Horn, Wagner, & Jalongo, 1989).

2.2.1. Self-control

Given that informant reports of self-control have demonstrated strong concurrent and factorial validity (Duckworth & Kern, 2011; Sulik et al., 2010), a standardized teacher rating scale designed especially for longitudinal assessment of classroom behavior, the Adjustment Scales for Early Transition in Schooling (ASETS; McDermott et al., 2013) was employed. ASETS was designed by McDermott et al. (2013) in cooperation with the federal government and was derived from the Head Start Impact Study (DHHS, 2010b) as based on large and broadly representative longitudinal cohorts of children eligible for Head Start entry.

Each ASETS item is dichotomous indicating the presence or absence of a given behavior over the past month. Two of the scales pertain specifically to self-control problems; Aggression features 32 items and Attention Seeking 12 items. Moreover, the items are presented in particular classroom situations (involving teacher, age-mates, learning situations, organized play, group activities) in order to provide context and motivational clues about observed problem behavior. In addition to items that reflect either aggressive or attention seeking behavior, each situation presents items that would alternatively describe withdrawn or disengaged behaviors, and in order to diminish negative response sets, at least one item that describes normal or commonplace behavior (none of these items contribute to the Aggression or Attention Seeking scales). Example Aggression items include, "Physically aggressive in peer conflicts," "Answers with threats when corrected," "Tries to push in front of others in lines," "Starts fights and rough play during games," "Makes unprovoked attacks on other children," whereas Attention Seeking items include, "Insists on sitting next to teacher," "Tells on others to gain teacher's favor," "Much too talkative with teacher," and "Seeks help when not needed."

Each scale is based on longitudinal exploratory and confirmatory structural analyses across the four academic years, with item response theory (IRT) calibration under the two-parameter logistic model, vertical equating using nonbiased linking items, and scaled scores (SSs) via expected a posteriori (EAP) Bayesian estimation where the population $SS\ M = 50$ and $SD = 10$ at PreK 1, the reference year. Internal consistency as derived directly from the IRT EAP scores and their standard errors was .96 for Aggression and .87 for Attention Seeking. Substantial evidence for concurrent and predictive criterion validity, as well as sensitivity to linear and higher-order growth detection was provided by McDermott et al. (2013). Canonical redundancy analysis for the HSIS longitudinal sample shows that 61.1% of the variation in Aggression is unrelated to Attention Seeking and 64.7% of the variation in Attention Seeking is unrelated to Aggression. Given these psychometric characteristics, ASETS has been used in other research with preschool children (Cooper & Lanza, 2014).

2.2.2. Distal outcome measures

Three types of outcome measures were employed to assess independently the validity of any latent subpopulations of growth trajectories for Aggression or Attention Seeking—direct assessments of achievement, teacher ratings of relationships with children, and parent ratings of observed behavior problems, all measures collected toward the close of 1st grade. As direct assessments of achievement, the Basic Reading Skills cluster (letter and word reading and writing, phonemic and structural analysis) and Mathematics Reasoning cluster (quantitative concepts,

counting, problem solving) of the Woodcock–Johnson III Tests of Achievement (WJ; Woodcock, McGrew, & Mather, 2002) were administered. HSIS 1st-grade population internal consistency was .91 for Basic Reading Skills and .78 for Mathematics Reasoning (DHHS, 2010b). Ample validity support has been reported for the two WJ achievement clusters (Dumont & Willis, 2006; McGrew, Schrank, & Woodcock, 2007; Salvia, Ysseldyke, & Witmer, 2017).

Independent ratings of teacher relationships were obtained from the Positive Relationships with Teacher scale of the Pianta Student–Teacher Relationships Scale (Pianta, 1996). Items such as, “I share an affectionate, warm relationship with this child,” are rated on a 5-point scale ranging from 1 = “Does not apply” to 5 = “Definitely applies.” The scale consists of 15 items with an internal consistency reliability coefficient of .89 reported by HSIS (DHHS, 2010b). Substantial concurrent and predictive validity evidence is provided (Pianta, 2001; Pianta & Stuhlman, 2004).

Parents were asked to rate children’s aggressive or defiant, hyperactive, and withdrawn or depressed behavior using the Total Behavior Problems scale. The scale contained 14 dichotomous items, such as, “Is disobedient at home,” “Can’t concentrate, can’t pay attention for long,” and “Doesn’t get along with other kids.” Development and validity evidence are provided for the FACES national study (DHHS, 2001, p. 2.27) and for HSIS in DHHS (2010b). Additional validity evidence has been reported by other researchers (e.g., Vaden-Kiernan et al., 2010; Ziv, Alva, & Zill, 2010). For the 1st-grade sample as reported for HSIS, internal consistency ranged .78–.79.

2.3. Procedure

Prior research and theory that identified unique subgroups of developmental self-control motivated three research hypotheses that respectively recommended the applications of latent growth mixture modeling (GMM; Grimm, Ram, & Estabrook, 2017; Wickrama, Lee, O’Neal, & Lorenz, 2016) to identify any unobserved subpopulations of longitudinal change in Aggression and Attention Seeking, the regression of distal outcomes on resultant latent classes, and the regression of those latent classes on antecedent covariates representing child demographic and education-related factors. *Mplus* version 7.3 (Muthen & Muthen, 2015) was used for all analyses, with imputation of missing data under full-information maximum-likelihood estimation. Models were estimated separately for Aggression and Attention Seeking through series of both fixed (linear and polynomial) and latent basis approaches across the four academic years. Models were regarded preferable that simultaneously produced: (a) lower values for Akaike’s Information Criterion (AIC), Schwarz’s Bayesian Information Criterion (BIC), and Adjusted BIC (ABIC) than found for less complex models (Nylund, Asparouhov, & Muthen, 2007); (b) the minimal values for the Integrated Classification Likelihood with Bayesian-type Approximation (ICL-BIC; McLachlan & Peel, 2000); (c) maximal values for entropy and average posterior classification accuracy (Greenbaum, Del Boca, Darkes, Wang, & Goldman, 2005; Nagin, 1999); (d) statistical significance for contrast with the model featuring one less latent class as per the Vuong–Lo–Mendell–Rubin, Lo–Mendell–Rubin, and parametric bootstrap (using 100 draws) likelihood ratio tests (Nylund et al., 2007); and (e) theoretically meaningful results (Ram & Grimm, 2009).

Given the preferred growth model for Aggression and Attention Seeking, respectively, binary distal outcomes were generated and regressed on the latent class variables formed by the most likely posterior classifications. Binary outcomes were appropriate because: (a) the alternative WJ normal-curve equivalent scores and teacher and parent raw score ratings were significantly abnormally distributed and differentially skewed; (b) the WJ item-domain representation was relatively sparse below the 25th percentile with

punctuated rather than graduated changes in item difficulty (a problem common to commercial tests; see McDermott et al., 2009); and (c) they would yield relative probabilities of desirable versus undesirable outcomes in late 1st grade as a function of membership in each derived latent growth class. Thus an outcome reflecting Reading Proficiency versus Nonproficiency was formed from WJ Basic Reading Skills, where Proficiency comprised performance in the upper three quartiles (scored 0) and Nonproficiency the lowest quartile (scored 1). A Mathematics Nonproficiency variable was formed from WJ Mathematics Reasoning (lowest quartile = 1). Variables for Pianta Positive Relationships with Teacher and parent-observed Total Problem Behaviors utilized a similar strategy (upper quartile = 1). Quartiles were preferred because they provided the necessary statistical power for reliable point separation in logistic modeling (Stokes, Davis, & Koch, 1995). The lowest quartile (non-proficiency) was selected for reading and mathematics because, in common practice, it is the nonproficient status that triggers intervention and retention decisions and the upper quartile was chosen for teacher and parent ratings because that category coincides with the nominal title designation (‘positive’ or ‘problem’) for the respective measures. Probabilities of better versus poorer outcomes associated with each latent growth class were obtained using the *Mplus* DCAT function.

The 3-step method (Asparouhov & Muthen, 2014) was applied to regress resultant latent classes on the preexisting demographic and education-related predictor variables while accounting for measurement error in posterior classifications. Each model held the predictor variables as simultaneous binary explanatory indicators (child sex, ethnicity [Latino, African American, with White and others as reference group], English as a secondary language [ESL], provision of special needs services, mother’s completion of high school) in a multinomial logistic regression model using the general logit link function. The objective was to ascertain the relative risk (estimated through the odds ratio) associated with each predictor, the predictors having been found relevant in prior research on growth of Aggression and Attention Seeking (McDermott et al., 2013).

3. Results

3.1. Latent growth models

The longitudinal variable observations were nested within teachers who may have observed more than one child. Latent growth mixture modeling provides no practical mechanism for estimating parameters that are nested longitudinally. Rather, we calculated the harmonic mean number of children assessed by teachers for each dependent variable during each year and the associated design effect (Snijders, 2005). The grand harmonic mean number of children assessed per teacher = 1.16 (range 1.08–1.20), yielding a trivial grand mean design effect = 1.02 (range 1.01–1.03) for Aggression and 1.03 (range 1.01–1.05) for Attention Seeking where 1.00 indicates absence of variation between teachers. Thus any nesting effects are regarded as essentially inconsequential.

Models derived through polynomial growth estimates were uniformly better fitting than those through latent basis estimation. Supplementary Table A presents properties, fit statistics, and parameter estimates for the best alternative models pertaining to Aggression and Supplementary Table B to Attention Seeking. In all instances, models estimating quadratic curvature provided best fit, with linear slopes variability consistently nonsignificant statistically (and thus fixed to 0.0) and quadratic slopes variability significant. The latter indicates that, whereas changes in children’s trajectories of self-control problems within the various latent classes did not vary linearly, change trajectories did vary quadratically among children within classes. Moreover, estimates

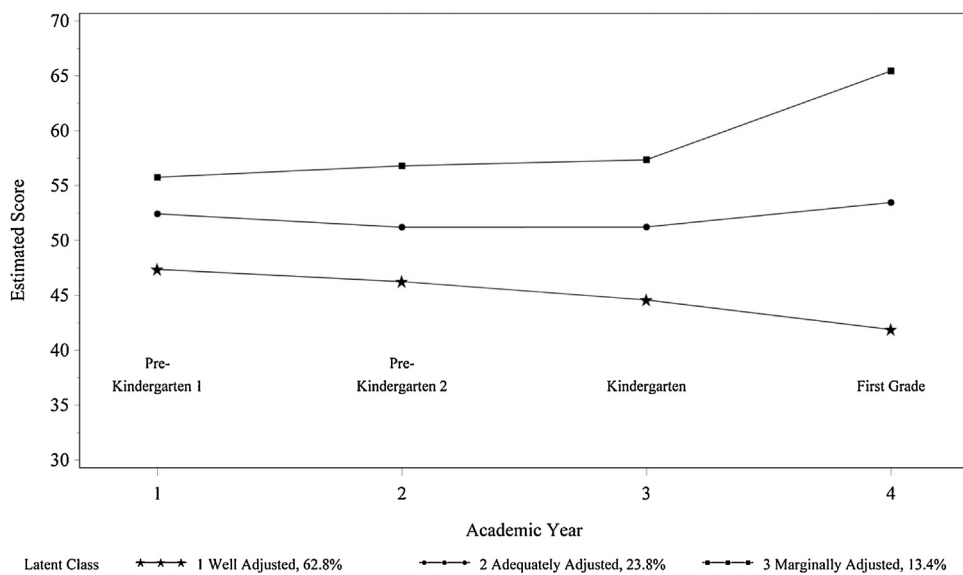


Fig. 1. Estimated mean latent growth trajectories for Aggression.

of residual variance were allowed to vary across academic years, producing better model fit as partly related to the differing amounts of missing data over time. For Aggression, the 3-class model was preferable and for Attention Seeking the 2-class model, having met all of the stated criteria including minimal ICL-BIC, which is known to correctly identify the best solution even when covariances are misspecified (Frühwirth-Schnatter, 2006, pp. 214–215; McLachlan & Peel, 2000, pp. 217–220).

Fig. 1 displays the estimated mean trajectories for the 3-class Aggression model and Fig. 2 for the 2-class Attention Seeking model. For convenience, the lowest classes (in terms of SSs) are named Well Adjusted and the highest classes Marginally Adjusted, reflecting the SS levels at the culminating point in Spring of 1st grade. The middle class for Aggression is named Adequately Adjusted because mean SS values never reach or exceed 1 SD above the population mean (the criterion for problematic adjustment in related research; McDermott et al., 2016, and Rikoon, McDermott, and Fantuzzo, 2012). Based on posterior membership estimates for the Aggression classes, 62.8% of children were classified Well Adjusted, 23.8% Adequately Adjusted, and 13.4% Marginally Adjusted, while for Attention Seeking, 75.6% were classified Well Adjusted and 24.4% Marginally Adjusted. Thus membership for Well Adjusted classes is about two- or three-fold the size of Marginally Adjusted classes. Additionally, the figures reveal characteristic negative quadratic trends for the Well Adjusted classes (children manifesting decreasing self-control problems over the years), whereas the Marginally Adjusted classes manifest positive quadratic trends (increasing problems).

Ancillary growth mixture models were tested for subsamples of children who were first enrolled at PreK 1 and children enrolled at all time points. The resultant mean growth levels and patterns were essentially the same as those for the full imputed sample. Resulting random effects were likewise similar. This supports the assumption that the children in the full sample were observed at random with some data missing at random and unrelated to levels of or changes in the outcome variables (Little & Rubin, 2002; Marini, Olsen, & Rubin, 1980).

3.2. External validity evidence

Figs. 3 and 4 illustrate the relative probabilities of each distal outcome associated with each latent growth class for Aggression

and Attention Seeking, respectively. Thus, for example, Fig. 3a shows that the mean probability of Reading Nonproficiency at the close of 1st grade increased significantly from .21 when children's growth patterns for Aggression were classified as Well Adjusted, to .29 if classified Adequately Adjusted, to .39 if Marginally Adjusted. In reverse order, Fig. 3c shows that as Aggression growth pattern classes moved from Well Adjusted to Marginally Adjusted, children were increasingly less likely to be seen as having Positive Relationships with Teachers (mean probabilities .38 and .03, respectively). Likewise, Fig. 4d shows that parent-observed behavior problems became more likely as Attention growth patterns changed from Well Adjusted to Marginally Adjusted (mean probabilities .19 and .32, respectively). The only nonsignificant separation in mean probabilities was found between Adequately and Marginally Adjusted Aggression growth patterns in detecting Mathematics Nonproficiency. Otherwise, it is clear that the Aggression and Attention Seeking growth classes demonstrated significant and appropriately distinct associations with relevant late 1st-grade outcomes.

3.3. Antecedent variables

Table 1 presents results of the generalized multinomial logistic regression of the Aggression latent growth classes on antecedent variables, and Table 2 presents similar information for the Attention Seeking growth classes. Only statistically significant effects remain in the final models as reported in the tables, and each variable is controlled for the other variables in a given model. For Aggression (Table 1), male children, African-American children (vs. others), and those provided special needs services were found at significantly greater risk for inclusion in the Marginally Adjusted growth class compared to the Well Adjusted reference class, while children's use of English as a secondary language (ESL) and mothers' completion of high school operated as significant protective factors for the same comparison. When comparing risk of Adequately versus Well Adjusted class membership, male sex and special needs status continued as risk factors (although less so than for the Marginally vs. Well Adjusted comparison) and ESL status remained a protective factor. For the Attention Seeking comparison, membership in the Marginally Adjusted versus Well Adjusted classes (Table 2), male sex, and special needs inclusion again served as risk factors and ESL status as a protective factor. No statistically significant interactions were found.

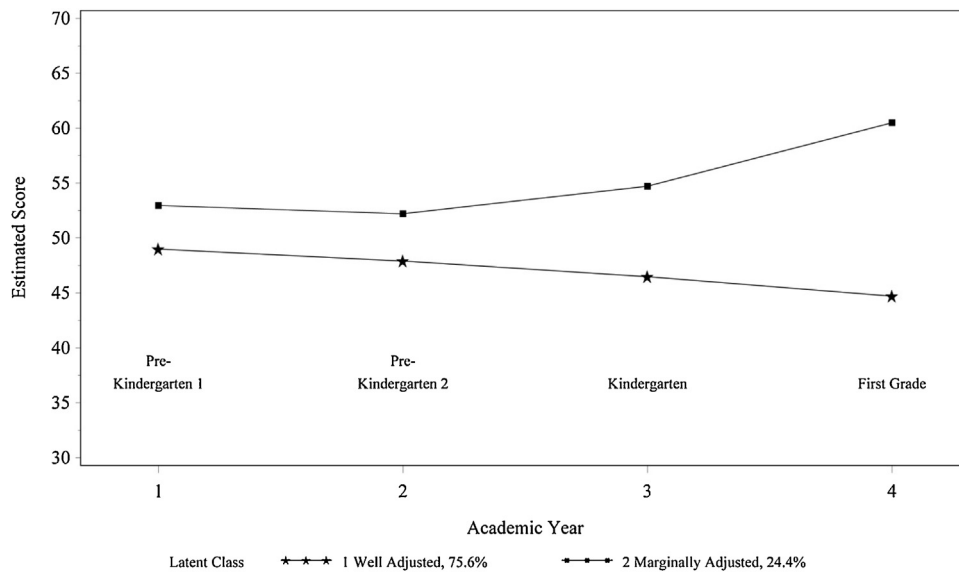


Fig. 2. Estimated mean latent growth trajectories for Attention Seeking.

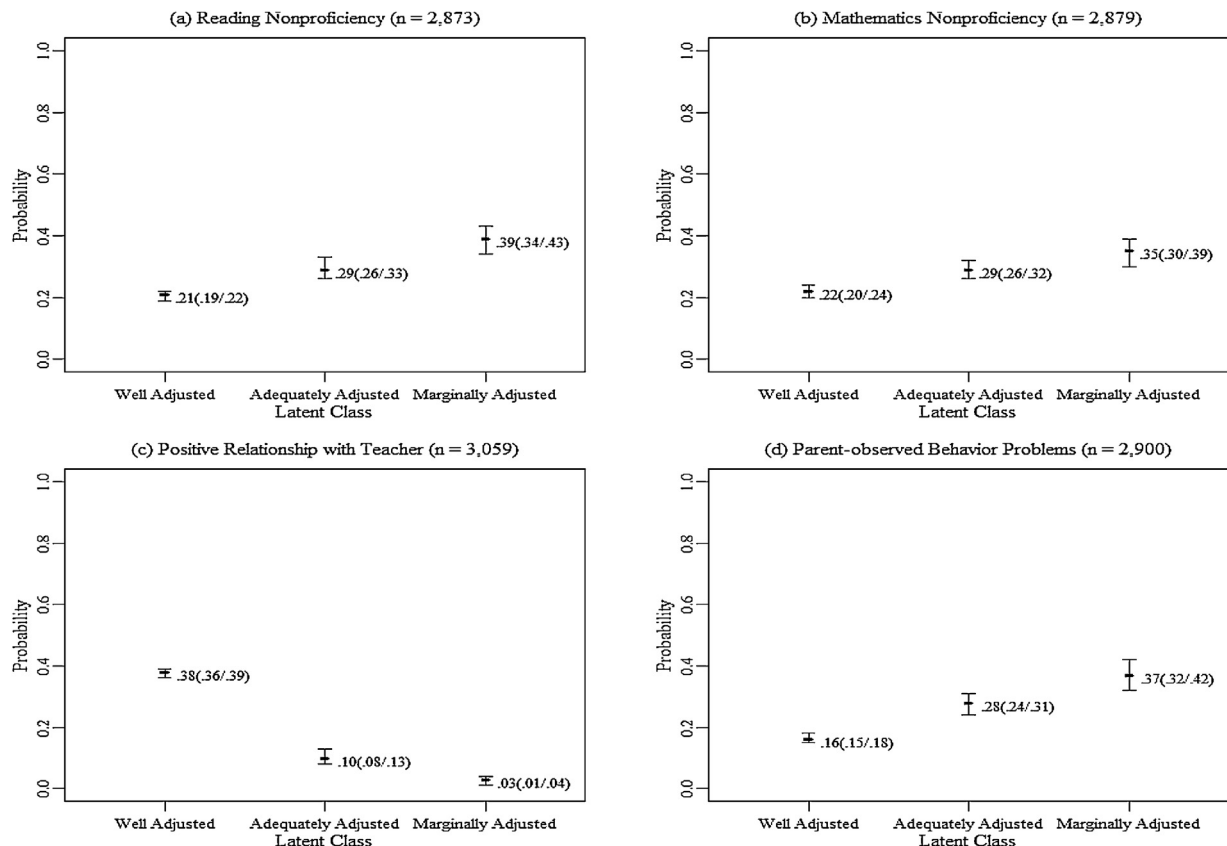


Fig. 3. Predicted mean probability (and 95% confidence bands) of Spring first-grade outcomes associated with membership in latent classes of Aggression.

4. Discussion

This study assessed three hypotheses. First, we hypothesized the existence of multiple latent developmental subpopulations for both aggressive and attention seeking forms of self-control problems among children from the most underresourced families in the country. The focus was on aggressive and attention seeking behavior because those are the specific subtypes manifest nationwide

in early education; that is, the subtypes of self-control problems characteristic of broad community rather than clinical populations. The earliest manifestations of such problems tend to take the form of physical aggression, rule breaking, or property destruction that appear among 2- and 3-year-olds and then peak around 4 or 5 years of age, where after they ordinarily decrease in frequency and severity as children age (Tremblay, 2010). The 3- to 4-year-old range is exactly where the American HSIS sample began classroom

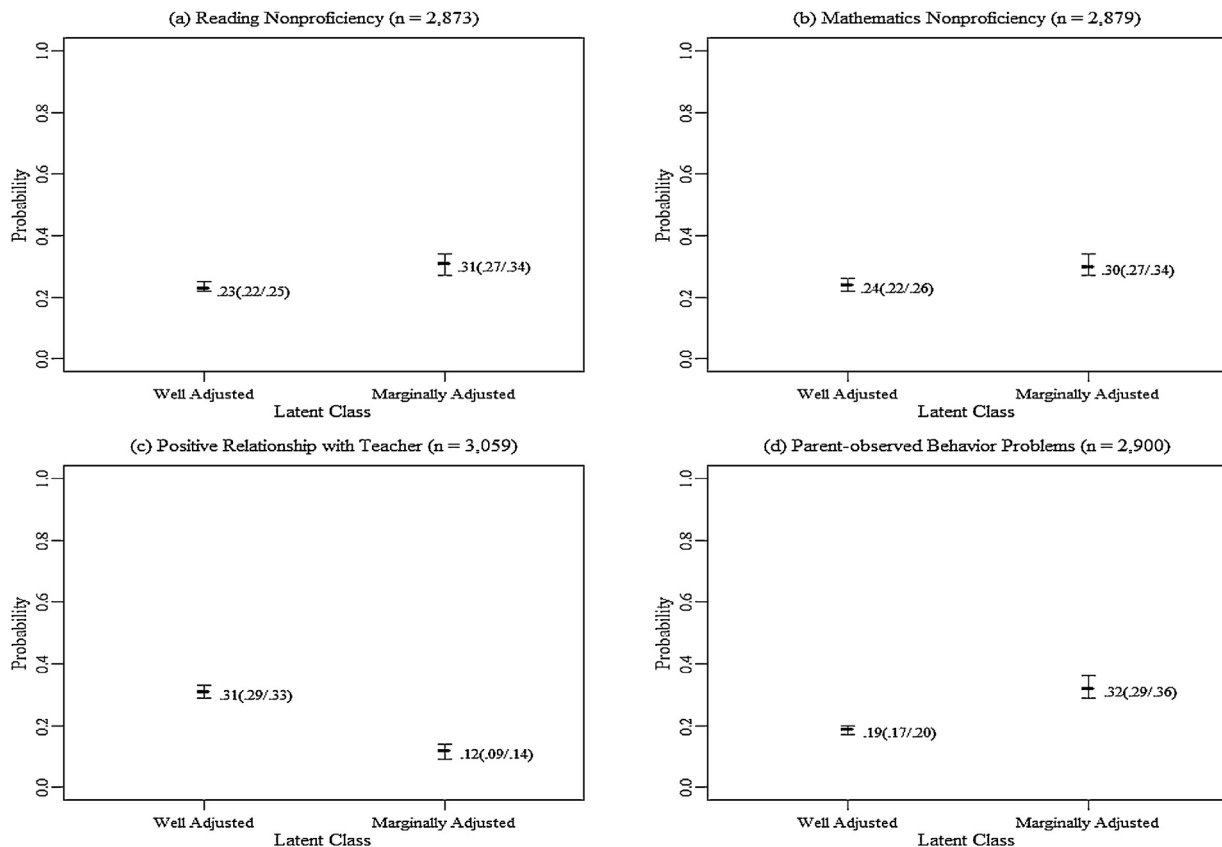


Fig. 4. Predicted mean probability (and 95% confidence bands) of Spring first-grade outcomes associated with membership in latent classes of Attention Seeking.

Table 1

Relationship between antecedent variables and latent classes of change in aggression.

Explanatory variable	Odds ratio (95% confidence limits)	% Risk increment ^a	% Risk reduction ^b
Odds for classification as Marginally Adjusted (latent class 3) vs. Well Adjusted (latent class 1)			
Child is male (vs. female)	3.41 (2.66/4.37)	241.1	
Child is African American (vs. other ethnicity)	2.17 (1.68/2.80)	116.6	
Child uses English as a secondary language	0.46 (0.32/0.65)		54.4
Child is provided special needs services	1.95 (1.42/2.68)	94.8	
Mother has completed high school	0.65 (0.51/0.83)		35.1
Odds for classification as Adequately Adjusted (latent class 2) vs. Well Adjusted (latent class 1)			
Child is male (vs. female)	1.90 (1.57/2.29)	89.8	
Child is African American (vs. other ethnicity)	1.12 (0.90/1.40)		
Child uses English as a secondary language	0.61 (0.47/0.78)		39.5
Child is provided special needs services	1.76 (1.35/2.31)	76.5	
Mother has completed high school	0.92 (0.75/1.13)		

Note. Values are estimated through multinomial logistic regression applying the generalized logit link function, where the latent growth classes are regressed simultaneously on explanatory variables and latent class 1 (Well Adjusted) is the reference group.

^a Entries equal odds ratio – 1 (100).

^b Entries equal 1 – odds ratio (100).

Table 2

Relationship between antecedent variables and latent classes of change in attention seeking.

Explanatory variable	Odds ratio (95% confidence limits)	% Risk increment ^a	% Risk reduction ^b
Odds for classification as Marginally Adjusted (latent class 2) vs. Well Adjusted (latent class 1)			
Child is male (vs. female)	1.49 (1.24/1.80)	49.2	
Child uses English as a secondary language	0.54 (0.43/0.68)		46.0
Child is provided special needs services	1.47 (1.12/1.91)	46.5	

Note. Values are estimated through multinomial logistic regression applying the generalized logit link function, where the latent growth classes are regressed simultaneously on explanatory variables and latent class 1 (Well Adjusted) is the reference group.

^a Entries equal odds ratio – 1 (100).

^b Entries equal 1 – odds ratio (100).

assessments and the peak in aggressive behaviors in pre-K and subsequent decrease is consistent with the observation that problem levels actually do dissipate for the majority of children (62%–75%) as time passes. This is likely related to the socializing influences of schooling and developmental encounters with people and situations that do not tolerate aggression or excessive attention seeking (Tremblay, 2010). But the developmental trend is also likely motivated by a host of epigenetic, familial, and community mechanisms that interact to sculpt normative behavior patterns (Meldrum et al., 2017; Raine et al., 2005; Tremblay, 2010).

In contrast to other large developmental cohort studies, this investigation identified distinctive growth patterns for attention seeking behaviors across the early education transition period. Similar to other studies that show general decreases in self-control problems as children age, the present study also reveals latent subpopulations that instead appeared very young with elevated problem levels and increase in severity, especially as children transitioned from prekindergarten. Some of these subpopulations (representing about 13% of developmental trajectories for aggression and 24% for attention seeking) are distinct enough to be regarded as marginally adjusted or normatively subclinical by the close of 1st grade.

Second, we hypothesized that these early growth trajectories for aggressive and attention seeking self-control would be associated with academic and interpersonal adjustment at the end of first grade. We found that the Marginally Adjusted Aggression group was more likely to experience academic deficits and parent-reported behavior problems and less likely to manifest positive relationships with teachers by the end of first grade. Normatively high and sustained rates of aggression across the preschool years tend to continue into childhood and adolescence (Côté et al., 2007; Ettekal & Ladd, 2017) and may presage future educational and psychosocial difficulties (Barker & Maughan, 2009; Bevilacqua et al., 2018; Campbell et al., 2006; Côté et al., 2007; Hay, 2017; Jolliffe et al., 2017; Smith et al., 2014; Wildeboer et al., 2015). Thus, this group is at increased risk for future educational and psychosocial problems.

Prior research has also demonstrated that early inattentiveness adversely affects later adjustment and academic attainment (Carbonneau et al., 2016; Duckworth et al., 2012; Gray, Carter, Briggs-Gowan, Jones, & Wagmiller, 2014; Gray et al., 2017; Greven, Rijdsdijk, Asherson, & Plomin, 2012; Merrell et al., 2017; Sayal et al., 2015; Pingault et al., 2013, 2014; Polderman, Boomsma, Bartels, Verhulst, & Huizink, 2010; Rabiner et al., 2000; Salla et al., 2016). Although inattentiveness and attention seeking are not isomorphic constructs, we found that children in the Marginally Adjusted Attention Seeking group were significantly more likely to incur relatively serious literacy and numeracy deficits by the close of first grade. Those children were also less likely to manifest positive relationships with teachers and more likely to exhibit problem behaviors at home. Consequently, this group is also at increased risk for future educational and psychosocial problems.

Third, we hypothesized that antecedent demographic and education-related factors would predict relative risk or protection associated with membership in the subpopulations of emergent self-control problems. Although there is no direct evidence of causal underpinning for marginal adjustment in any subtype of poor self-control (aggression or attention seeking), it is clear that males and those with special needs are at greatest risk for increasing self-control problems, whereas ESL children have reduced risks for early and emergent self-control problems. Considering that two-thirds of the ESL children in the sample are Latino, with families having immigrated from South and Central America and the Caribbean, the latter finding comports well with previous research where early childhood social and behavioral skills have been identified as an area of strength for Latino children relative

to other cultural groups at low income in the U.S. (Bulotsky-Shearer, Lopez, & Mendez, 2016; Calzada, Fernandez, & Cortes, 2010; Castro, Mendez, Garcia, & Westerberg, 2002; Chang et al., 2007; Fuller & Garcia Coll, 2010; Halle et al., 2014). Consistent with prior research, boys exhibited lower levels of self-control than girls and African-American children were at greater risk for aggressive self-control problems (Feng et al., 2017; Kaufman et al., 2010; Moffitt et al., 2011; Montroy, Bowles, Skibbe, McClelland, & Morrison, 2016; Shaw & Taraban, 2017; Vazsonyi & Kelley, 2007; Wright, Morgan, Coyne, Beaver, & Barnes, 2014), while children whose mothers have more education were afforded some protection (Montroy et al., 2016). When controlled for other major influences, maternal education tended to reduce the likelihood of childhood behavioral problems (Carneiro, Meghir, & Parey, 2013; Nagin & Tremblay, 2001) just as it serves to foster better academic outcomes for children (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002; Diego Torres, 2015). This phenomenon is fairly well understood and appears to be rooted largely in the fact that educated mothers are more facile with language and literacy, provide more cognitively stimulating home environments, and themselves personify the accessibility and practical advantages of formal education (Davis-Kean, 2005; Walker et al., 2011).

4.1. Practice implications

Practitioners would be advised to think of most children from underresourced families as experiencing noticeable improvements in self-control or (for the Adequately Adjusted Aggression class) relatively stable self-control over the transition years. As an aid to those who would hope to afford early treatment via an evidence-based approach (Youngstrom, Choukas-Bradley, & Calhoun, 2015), we assessed the general relationships between children's score levels during the PreK years and their inclusion in more or less desirable latent subpopulations of change in aggression or attention seeking. Approximately 90% of children with SSs in aggression below the population mean (50) would be expected to improve or at least remain stable as they transition through post-PreK, with fewer than 1 out of 10 of these children inclined to manifest increasing aggression. However, at least 3 out of 10 children would tend to display increasing aggression over time when their PreK aggression SS exceeds 55. The higher the PreK aggression SS, the greater the risk of increasing aggression over time. In a similar manner, over 85% of children with PreK SSs below 50 in attention seeking are expected to improve over the transition years, with fewer than 1 out of 5 showing increased attention seeking. The likelihood of increased attention seeking approaches 2 out of 5 when PreK SSs reach 55 and the likelihood increases as PreK attention seeking SSs exceed 55.

Most of the variability in aggression operates independently of that in attention seeking such that children found with marginal adjustment for aggression are quite unlikely to be the same children found with marginal attention seeking (specifically, the correspondence of classification as both marginally adjusted in aggression and attention seeking is expressed by a Cohen's $\kappa = -.31$, indicating no correspondence in classification). This means that practitioners should think of aggression and attention seeking forms of self-control problems as rather independent assessments, with little likelihood that the same child would be regarded as having consequential problems in both areas. This observation would comport with a conceptualization of motivation which holds that aggressive behavior is intended to control property or dominate others whereas attention seeking is intended to gain notice and approval of others. This conceptualization is consistent with the defining motivational aspects that distinguish aggressive behavior from attention seeking behaviors, as presented in our introduction.

4.2. Limitations

Our research is limited by the depth and breadth of information collected for the national HSIS. We simply do not know the detailed classroom or larger environmental circumstances that substantially earmark membership in different latent classes of self-control problems among underresourced children. This would necessitate the more powerful lens afforded by a vastly more expansive and costly research design than the HSIS. We also are limited by an absence in the HSIS of a broader array of sociological/psychological information (e.g., neighborhood effects and self-control mechanisms among parents; see Gross & McDermott, 2008, and Meldrum et al., 2017) that might serve as useful control agents in determining the unique explanatory factors associated with early classroom self-control deficits. Nor does the HSIS study design provide any data to inform the contributions of genetics to observed behavior patterns (Saudino & Micalizzi, 2015). Further, it is important to emphasize that our research is designed to reveal salient latent growth trajectories and associated precursors and outcomes; it is not designed to answer questions about actual causality.

Although entirely necessary for the orchestration of reliable latent growth mixture modeling, the use of psychometrically integral dimensions of self-control problems (viz., aggression and attention seeking) at once limits the functional specificity of findings. Thus, whereas dimensional aggression, as an example, is necessarily comprised of a myriad of facets of different kinds of aggression (physical, covert, interpersonal, instrumental, impulsive), it is quite possible that the qualitative distinctions among these facets may hold the keys to why certain children seem to arrive on the scene with relatively marked overall aggression and then get worse, while others appear to remit tendencies over time (Duckworth & Steinberg, 2015). It is conceivable that children who early and uniquely manifest serious physical and provocative aggression are emblematic of the subpopulation that gets worse, while those showing early covert varieties are inclined to define the subpopulations that improve. Answers to these questions will require a different research tack, not unlike the longitudinal micro-analyses of behavioral facets demonstrated by Harrison, Vannest, Davis, and Reynolds (2012) and Tremblay (2010).

We employed GMM to identify and describe the developmental trajectories of latent subgroups in the population of preschool children. This methodology has been widely used in child development research (e.g., Montroy et al., 2016; Wildeboer et al., 2015; etc.) and assumes that the observed nonnormality of score distributions reflects a mixture of latent subgroups. However, Bauer and Curran (2003a) suggest that GMM may be inclined to identify subgroups in nonnormal data from a single population, so this assumption may not be correct. Thus, there may be no mixture of subgroups, only a nonnormal distribution of scores from a single group (Bauer & Curran, 2003a; Ram & Grimm, 2009). Given this ambiguity, it is prudent to reiterate that GMM is an exploratory technique that produces “statistical evidence that a mixture distribution for the repeated measures is preferable to a (usually) normal distribution.” (Sterba & Bauer, 2010, p. 248). The plausibility of subgroup interpretation can be evaluated much like the examination of construct validity: interpretability, replication, and the accumulation of empirical results “that are both consistent with the interpretation of population heterogeneity and inconsistent with alternative explanations” (Bauer & Curran, 2003b, p. 390; Bauer & Reyes, 2010). In that regard, our results are interpretable and consistent with prior research regarding the types of trajectories, antecedents, and outcomes. Replication and further research will be necessary to bolster the assumption of latent subgroups in this population.

Finally, measurement of self-control was accomplished with a standardized teacher rating scale. Self-control informant reports

have exhibited good convergent validity (Duckworth & Kern, 2011) and the instrument applied in this study has been employed in other developmental studies (Cooper & Lanza, 2014). As noted by Duckworth and Kern (2011), time and budget constraints often allow only a single informant report. Nevertheless, future research should investigate the aggregation of self-control measures across different contexts and methods (Duckworth & Kern, 2011; Sulik, Blair, & Greenberg, 2017).

5. Conclusion

This research has centered on the development of self-control problems exclusively among children already facing challenges associated with socioeconomic underresourcing. It does not address the situations facing children who are spared that general disadvantage. The viewpoint has been both longitudinal and retrospective/prospective. Most children from underresourced families experienced noticeable improvements in self-control or relatively stable self-control over the transition years. Further, there is no evidence that a child's transitional pattern and attendant outcomes are set in stone. For instance, there is much evidence to suggest that school and family can be powerfully influential both in a preventive and compensatory sense when it comes to averting behavior problems and their sequela in the early education years (Arnold, Zeljo, Doctoroff, & Ortiz, 2008; Bear & Manning, 2014; Diamond, Justice, Siegler, & Snyder, 2013; Fantuzzo et al., 2013; Lipschultz & Wilder, 2017; Nord & West, 2001; Piquero et al., 2016; Shaw & Taraban, 2017; Stoltz, van Londen, Dekovic, de Castro, & Prinzie, 2012). It is for this reason that the U.S. government has launched new broad initiatives (Mapp & Kuttner, 2013) to more directly engage all struggling families in the early education process.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.ecresq.2018.08.010>.

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