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National profiles of school readiness skills for Head Start children: An investigation of stability and change

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ABSTRACT

Among a nationally representative sample of 2336 Head Start children, patterns of school readiness were compared at the beginning and end of children's first preschool year, and predictors of stability and change across readiness profiles were examined. The present study documented that although the majority of children remain in a qualitatively similar school readiness profile across their first year in Head Start, 20% of children move to a qualitatively different profile over the school year, reflecting both improvements and declines in functioning. Child and family attributes (e.g., child age, ELL status, maternal education, and family structure), as well as contextual factors (e.g., teacher education and experience, parenting style, and parent involvement) were significant predictors of both profile stability and change. Given that we have little understanding about what factors practice or policy can manipulate to improve school readiness, these findings shed light on what we might do to promote school readiness and prevent declines in functioning over time. Thus, findings from this study provide a population- and pattern-based perspective of Head Start children's strengths and needs, relevant for informing both individual and systems level change in Head Start programs across the nation.

The early childhood period from preschool through kindergarten marks a major transition for young children and has been identified as a critical period for intervening with those considered at-risk for later school difficulties (National Institute of Mental Health, 2002; National Research Council & Institute of Medicine, 2001). School readiness skills that children develop during this period have been shown to have a lasting impact throughout elementary school (Duncan et al., 2007; Rouse & Fantuzzo, 2009). Skills such as relating well with children and adults outside of one's family, demonstrating knowledge of the basic conventions of letters and numbers, and showing positive approaches to learning are all part of the school readiness repertoire children must have to be successful in these early years and beyond (Snow, 2007). For the 11.7 million low-income children in the U.S. who are disproportionately impacted by the myriad concomitant risk factors of poverty (e.g., poorer quality housing, family instability, low levels of parental education, under-resourced schools), it is essential to identify proximal protective factors that mitigate these risks and bolster the skills children need as a foundation for success in school (Wright, Thampi, & Briggs, 2010). However, despite our best efforts to date, we know little about what factors practice or policy can manipulate to promote improved school readiness. The present study adds substantially to this knowledge base by: (1) describing population-based patterns of school readiness skills among a national Head Start sample and (2) examining malleable and contextual factors associated with stability and change of children's school readiness across time.

A developmental ecological model provides researchers and practitioners with a broad framework to consider the multiple and interacting influences on children's school readiness (Bronfenbrenner & Morris, 1998). This theoretical approach acknowledges the complexity of the individual child as well as the multifaceted hierarchical and nested influences of the child's context. For example, an individual child may reside in a low-income family, identifying him or her as being at-risk for future school difficulties, but this same child can also be viewed as having distinct configurations of skills that either enhance or impede school readiness, as well as a set of contextual influences serving as risks or assets that are unique to that child within the larger context of poverty. Such a risk-asset framework could be applied to examine improvement or decline in children's functioning over time. By understanding this across time, within-group variability among a national population of children at greater risk for problems in school, we come closer to an understanding of how best to intervene.

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Examinations of school readiness in national studies (e.g., National Institute of Child Health and Human Development [NICHD] Early Child Care Research Network, 2002) have told us much about how children's early skills relate to later school outcomes and how these outcomes differ based on child and family characteristics. However, these studies typically have been conducted through a variable-oriented lens, which assumes that while individuals differ quantitatively across variables, they are, on average, qualitatively alike in the nature of the relationships between variables (i.e., intra-individual differences are often considered random and, thus, negligible) (Bergman, Magnusson, & El Khouri, 2003). These assumptions may pose limitations for studying the dynamic and multidimensional developmental processes that characterize young children's experiences as they progress through the early childhood transition to school. Young children's skills, in the course of natural development, are in continual flux, developing simultaneously and transactionally (often unevenly) within and across domains, and are especially sensitive to the contributions of proximal environmental factors, such as those in the family and preschool classroom (National Research Council, 2008). Person-oriented research, in contrast to variable-oriented research, attends to these issues and tries to capture the dynamic development within individuals or homogeneous subgroups of individuals. Although *variables* are inherent in person-oriented studies, they derive their meaning as part of an inextricably interwoven and undivided whole (Bergman & Trost, 2006). Researchers argue that, absent person-oriented investigations, variable-oriented approaches may mask important subgroups within a population that could help inform evidence-based discussions of school readiness (Konold & Pianta, 2005). In fact, several researchers have argued that these two approaches (each with a tradition of utility in representing the whole child) provide complementary views of children's development (Bornstein, Suwalsky, Putnick, & Haynes, 2006; Hirsh-Pasek & Burchinal, 2006; McWayne, Green, & Fantuzzo, 2009) and that both approaches should be included in longitudinal designs (Laurson & Hoff, 2006).

The present study builds on recent person-oriented, population-based work (McWayne et al., submitted for publication) that examined the relations between multiple school readiness competencies and end of kindergarten academic and social adjustment, controlling for family and classroom factors in a national Head Start sample. In this prior study, empirically derived patterns of school readiness were identified *at the beginning* of children's first Head Start year (Fall 2000). Five profiles of school readiness were revealed: (1) Average Academic and Social Skills (prevalence = 28%), (2) High Behavior Problems at School/Low–Low-Average Social and Academic Skills (prevalence = 17%), (3) High Behavior Problems at Home/Average Academic and Social Skills at School (prevalence = 15%), (4) High Social Skills (prevalence = 21%), and (5) High Academic Skills (prevalence = 19%). These profiles related meaningfully to external criteria – both concurrent and end of kindergarten outcomes such as emergent numeracy, emergent literacy, and social behavior at home and at school. This initial study was the first of its kind for a national population of low-income preschool children and contributed to our understanding of how various preschool skills overlap to form distinct subgroups of children (see also McWayne, Fantuzzo, & McDermott, 2004).

In contrast to earlier person-oriented investigations of school readiness with national datasets (e.g., Konold & Pianta, 2005), a critical feature of this present line of research is its focus on skill-based assessments of children's school readiness (e.g., emergent literacy skills such as understanding print conventions [NICHD ECCRN, 2002] and children's classroom behavior [Rimm-Kaufman, Pianta, & Cox, 2000]). Skill-based dimensions were chosen as they are readily observable in the course of the normal classroom routine (thus, having ecological validity), and they are also meaningful within the majority of curriculum frameworks and, therefore, more amenable to teachers' efforts at intervening through curriculum and planning.

Although a clear focus of the proposed study was individual children's patterns of school readiness skills, a developmental ecological perspective attends to contributing factors operating both inside and outside of the individual. Child attributes such as age, gender, and English language learning status have been documented repeatedly as contributing to children's school readiness, such that older girls and English dominant preschool children tend to fare better on average (e.g., Hair, Halle, Terry-Humen, Lavelle, & Calkins, 2006). Family factors most often cited as influencing children's school readiness include mother's educational status and family composition, such that single-parent headed households characterized by low levels of maternal education place children at the greatest risk for adverse trajectories (Burchinal, Peisner-Feinberg, Pianta, & Howes, 2002). In the present study, these factors are considered with respect to the composition of school readiness profiles and as predictors of profile stability and change.

Beyond these child and family demographic factors, for preschool children, the most proximal outside influences on school readiness arguably occur within the home and preschool classroom settings, the most primary context for young children being that of the parent–child relationship. Within this key socialization relationship the coordination of affect, cognition, and behavior needed for positive school adaptation is acquired (Bornstein, 1995). Because of Head Start's unique two-generational mission (Zigler & Muenchow, 1992), an examination of parenting as it predicts stability and change of school readiness skills over time seems warranted. In general, authoritative parenting has emerged as the parenting style that is associated with the best social and academic outcomes (e.g., Baumrind, 1971; Estrada, Arsenio, Hess, & Holloway, 1987; Maccoby & Martin, 1983). This style is characterized by high levels of parental nurturance, involvement, sensitivity, reasoning, control, and encouragement of autonomy. In contrast, children of authoritarian parents (a style characterized by less warmth and more coercive, controlling, and punitive practices) demonstrate less favorable outcomes overall. However, cultural variation in the expression of authoritative and authoritarian parenting may contribute to variation in the impact of these parenting styles on children's outcomes (Brody & Flor, 1998; Chao, 2001; McWayne, Owsianik, Green, & Fantuzzo, 2008), particularly for low-income, culturally diverse families served by Head Start. Therefore, based on extant evidence, in the proposed study, both authoritative and authoritarian dimensions of parenting were examined as potential predictors of children's school readiness development.

In addition to parenting style, family involvement in children's early educational experiences is identified with school success (Zigler & Muenchow, 1992). Numerous studies demonstrate relationships between specific involvement behaviors and children's social and academic outcomes across the school years (Dearing, McCartney, Weiss, Kreider, & Simpkins, 2004; Marcon, 1999). Family involvement behaviors such as engaging in educational activities at home with one's child, volunteering at school, and encouraging pro-school behaviors are all part of the multidimensional construct of family involvement (Fantuzzo, Tighe, & Childs, 2000). Because family involvement has been identified as a key protective factor for low-income, ethnic minority children and youth (Jeynes, 2003), these parenting behaviors were also explored as possible predictors of school readiness stability and change in this Head Start sample.

With respect to the classroom setting, several studies have demonstrated strong associations between quality early childhood educational experiences and children's positive school outcomes (e.g., Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001; NICHD ECCRN, 2002). Indicators of quality include positive teacher–child relationships (Howes, 2000), a learning environment

rich in materials and language opportunities, and lower child to adult ratios (Burchinal et al., 2002). These qualities have been shown to confer relatively stronger benefits to children considered at higher risk for school failure (Burchinal et al., 2002). In summary, identification of contextual factors such as family involvement, parenting style, and classroom quality that may predict school readiness stability and change is critical, as Head Start is in a position to intervene with these processes.

The current study aims to build on the small body of work integrating person- and variable-oriented approaches in the study of school readiness, while expanding this research to a nationally representative sample of young, low-income children and their families served by the federal Head Start program. Our research questions are as follows: (1) what distinct patterns of children's school readiness skills can be identified *at the end* of their first Head Start year? How do these profiles relate to child demographics and external academic and social skills criteria? (2) Across children's first Head Start year, what is the nature and extent of stability and change in these empirically derived profiles of school readiness? (3) What child, family, and classroom factors account for stability and change of profile membership across this time period?

Guided by our prior study's findings (McWayne et al., submitted for publication) and the existing school readiness literature, four sets of hypotheses were set forth. First, we expected that reliable and meaningful school readiness profiles would be identified at the end of children's first Head Start year (as per Konold & Pianta, 2005; McWayne et al., 2004). Second, we hypothesized that these profiles would relate in predictable ways to child demographics and external criteria. For example, based on work by McWayne et al. (2004) with a regional sample, we expected the higher performing profiles to be comprised disproportionately of older children and girls. We also hypothesized the lower performing profiles to be comprised disproportionately of English language learners and children with diagnosed disabilities. We had no expectations with respect to race/ethnicity in this low-income sample. In addition, we expected that children comprising the higher performing profiles would fare better on concurrent and later markers of school success. Third, it was hypothesized that profiles identified at the beginning of children's first Head Start year (from McWayne et al., submitted for publication) would replicate generally at the end of their first Head Start year, and children would demonstrate relative stability within a given profile over time (as per Laursen, Furman, & Mooney, 2006).

However, because early childhood is a period of dynamic development, we also expected that there would be some individual change in profile membership across time, such that a substantial minority of children would show either declines or improvement in functioning. We hypothesized, that of those children whose readiness profile changed qualitatively across the Head Start year, contextual factors related to this change would be: maternal education and family composition (with low maternal education and single-parenting serving as risks across this transition), parenting style, parent involvement, and classroom quality (with higher quality indicators positively influencing profile membership across time) (see McWayne et al., submitted for publication).

1. Methods

1.1. Data source

This study utilized the Head Start Families and Child Experiences Survey (FACES) 2000 cohort data, a national probability sample of first year Head Start children (U.S. Department of Health and Human Services, Administration for Children and Families, Office of Planning, Research, & Evaluation [US DHHS ACF OPRE], 2005). Children were followed through four waves of data collection: from entry into Head Start (fall 2000), spring of their first year in Head Start (spring 2001), spring of their second year in Head Start (for three-year old children; spring 2002), and spring of their Kindergarten year (spring 2002 for four-year old or 2003 for three-year old children). The sample was stratified by geographical region (Northeast, Midwest, South, West), urbanicity (urban, rural), and percentage of racial/ethnic minority families in the Head Start program (less than 50%, 50% or more). There were 45 programs selected using systematic sampling with probability proportional to size based on the program's first year enrollment. Two programs were defunded resulting in 43 sampled programs. Classes within programs that had first-year Head Start students (main sample) and a subsample for reserve were sampled with equal probabilities. There were 286 eligible classes from which all first-year Head Start children were selected to participate ($N = 2790$). More detail about the complex sampling design can be found in the FACES 2000 Data User's Guide (US DHHS ACF OPRE, 2005).

1.2. Missing data

1.2.1. Person-oriented analyses

For the multistage, hierarchical cluster analyses (which require a complete dataset), missing data for all child-level school readiness variables were imputed via the expectation maximization (EM) algorithm for ML in SPSS (Allison, 2002). Missing cross-sectional data ranged from 3% to 10% for the variables of interest, a relatively small proportion of the overall data, and, therefore, acceptable for this purpose. As a result of the initial exclusion criterion (i.e., non-English, non-Spanish speakers) and later trimming for outliers (2%) as part of the analysis stage, the final sample included 2336 children for Spring 2001 (the end of children's first Head Start year).

1.2.2. Variable-oriented analyses

The sample size for the multilevel multinomial/binary logistic regressions differed from that of the cluster analyses for the reasons detailed here. By design, there were 1751 children who had both fall 2000–spring 2001 longitudinal child base and classroom weights (weighting is not possible in the megaclustering procedure, thus there was no allowance for removing cases without weights). For these analyses (described below), missing data were treated at both the child and classroom levels as follows. At the child level, Iterative Markov chain Monte Carlo (MCMC) multiple imputation was performed using SPSS Missing Value Analysis (v. 17) on the parent covariates. There were 193 cases (approximately 11.0%) with missing values on the child and/or parent demographics. These cases were deleted using listwise deletion. The classroom-level variables used in the models were measured during spring 2001. There was relative stability in classroom measures from Fall 2000 to Spring 2001 (i.e., no statistically significant mean differences for either the ECERS-R mean or the Arnett: $p = .802$ and $p = .231$, respectively). Thus, it was deemed reasonable to use the fall values as replacement values for spring. There were 75 cases (approximately 4%) where teacher demographic data were missing for both the fall and spring. These cases were deleted using listwise deletion. The resulting final sample size for the multilevel logistic regression was 1483. This represented approximately six children within each classroom ($n = 262$ classrooms). Of note, because of the sample size differences between the cluster and multilevel logistic models, regression analyses were conducted to examine the relationship between school readiness indicators and sample demographics. Using the cluster analysis sample relative to the multilevel sample produced comparable results. This suggests that while there are differences in the sizes of the samples, the results are still representative across children.

1.3. Sample demographics

Only children whose primary language was either English or Spanish were included (92.2% of the overall FACES 2000 sample); all other ELL children were excluded because they were not able to be assessed in their primary language on some of the main school readiness variables of this study. Approximately equal percentages of boys and girls were included in this study (49.3% girls). The average age at Head Start entry was 49.94 months (*SE* = .31). The largest majority of children were White (34.5%) followed by Black (32.6%) and then Hispanic (28.1%). About 14% of the children were identified as having a disability. Most children lived in a mother-male household (47.6%) or mother-only household (31.1%). About 35% of mothers had less than a high school education, with about 37% holding a high school diploma or GED. Approximately 13% of teachers in this sample indicated having less than some college education, while 51.3% reported having some college or an associate's degree, 20% held a bachelor's degree, and 16.0% attended graduate school or held a graduate degree. Teachers averaged 11.63 years of teaching experience.

1.4. Measures

The measures of school readiness employed in this study represent a combination of direct child assessments, teacher report, and parent report. For clarity, an Appendix provides a summary of measures, organized by whether the measure was employed to create the profiles of school readiness, served as an external criterion indicator, or was a contextual variable in the multilevel analyses. Of note, all measures used to create the profiles met the following criteria: reliability above .60, predictive validity, observable, and mutable skills commonly identified by teachers as important for classroom functioning. Profiles were derived on six school readiness measures collected in spring 2001: three pre-academic and three social functioning.

1.4.1. Preacademic

The General Cognitive Score was adapted from the Cognitive subtest of the Child Observation Record (COR; High/Scope Educational Research Foundation, 1992). It was a composite score based on teachers' ratings of how well the child solves problems, engages in complex play, shows interest in reading, and exhibits classification skills by sorting objects. Print Conventions was derived from answers to a set of questions that pertained to children's knowledge of the left-to-right and up-and-down conventions of reading administered by independent assessors. The one-to-one counting task was a subtest of the CAP Early Childhood Diagnostic Instrument (Mason & Stewart, 1989), and asked children to count the number of teddy bears presented on a page. An independent assessor then rated children's counting ability using a 5-point scale, where a score of 5 indicated that a child made no mistakes, and a score of 1 indicated that a child could not count or did not try to count.

1.4.2. Social functioning

The three measures of social behavior included Behavior Problems (per parent report), Behavior Problems (per teacher report), and Cooperative Classroom Behaviors (per teacher report). The items comprising the Behavior Problems scale came from an abbreviated adaptation of the Personal Maturity Scale (Alexander & Entwisle, 1988), the Child Behavior Checklist for Preschool-Aged Children, Teacher Report (Achenbach, Edelbrock, & Howell, 1987), and the Behavior Problems Index (Zill, 1990). The questions asked about the frequency of aggressive, hyperactive, anxious, or depressed and withdrawn behaviors. Cooperative Classroom Behavior scores were based on teacher ratings of how often the child engaged in positive classroom behaviors such as cooperation, sharing, and expressing feelings. These ratings included items drawn from the Personal Maturity Scale (Alexander & Entwisle, 1988) and the Social Skills Rating System (Elliot, Gresham, Freeman, & McCloskey, 1988).

1.4.3. Concurrent criterion validity

Two subtests from the Woodcock-Johnson Psycho-Educational Battery – Revised (WJ-III; Woodcock & Johnson, 1989) were used to test concurrent validity of the profiles: Letter-Word Identification and Applied Problems. These subtests were administered to all children in English in spring 2001. Letter-Word Identification measured symbolic learning, and letter and word recognition. Applied Problems measured children's skill in analyzing and solving practical problems in mathematics, and executing simple counting, addition or subtraction operations. Receptive vocabulary was measured using the Peabody Picture Vocabulary Test (PPVT-III; Dunn & Dunn, 1997). In the PPVT-III administration, children were asked to identify from a set of four pictures an image that corresponds with a word. Children's social skills at school were rated by teachers using items adapted from the Child Observation Record (COR; High/Scope Educational Research Foundation, 1992). Teachers rated children on how well they made friends, worked with other children, and understood and expressed feelings. Parents also rated their children's social skills and positive approaches to learning across seven items, which asked about their ability to make friends, accept others' their ideas, persist in learning, and try new things.

1.4.4. Predictive criterion validity

In the spring of children's kindergarten year, the Phonemic Analysis test from the Test of Language Development (TOLD; Newcomer & Hamill, 1997) was employed to assess children's awareness of phonemes (the significant speech sounds that comprise words). The Applied Problems subtest from the Woodcock-Johnson III was again employed to assess early mathematics skills. A measure of General Knowledge, used with the ECLS-K cohort, tapped skills in the natural sciences (e.g., children's conceptual understanding of why things occur as they do and their ability to pose questions and investigate answers in the natural sciences) and social studies (e.g., children's basic knowledge of History, Government, and Culture). Teacher-reported social skills were measured via the Cooperative Classroom Behavior scale described earlier. Measures of problem behavior in kindergarten included both teacher and parent reports; items were derived from an abbreviated adaptation of the Personal Maturity Scale (Alexander & Entwisle, 1988), Child Behavior Checklist for Preschool-Aged Children, Teacher Report (Achenbach et al., 1987), and Behavior Problems Index (Zill, 1990).

1.4.5. Context factors

All classroom and family context factors were measured in spring 2001. Four self-report measures of parenting context were included. Authoritative Parenting was measured via four items (e.g., following through in dealing with misbehavior, sharing warm intimate moments with one's child), and Authoritarian Parenting was measured via three items (e.g., "I believe children should be seen and not heard.") taken from surveys used in the National Longitudinal Survey of Youth (NLSY) and the Early Head Start Evaluation (EHS). Parents' involvement in Head Start program activities was a composite variable created from 15 items (drawn from surveys used by the Head Start Quality Research Consortium) that measured frequency of participation in activities at the child's Head Start center, such as volunteering in the classroom and preparing materials for special events. Parents' involvement with children in the home setting (e.g., told a story, taught letters, words, or numbers, took child to library, museum, and visited a zoo or aquarium) was a composite variable created from 15

items (yes or no question format) that included both weekly (8 items) and monthly activities (7 items). The scale was adapted from the National Household Educational Survey by the FACES research team. In addition, family demographic variables were measured: family composition/structure (i.e., whether a child lived in a: (1) mother-male household; (2) single-parent household; or (3) mother-grandmother household or other configuration) and maternal education.

Five measures of classroom context were employed. The Arnett Caregiver Interaction Scale (Arnett, 1989), a rating scale of teacher behavior toward children in the classroom, consisted of 30 items. At the end of a 30-min observational period, the observer completed the scale for an individual teacher. Ratings were assigned on a scale of 1–4, with a higher score indicating greater teacher sensitivity, responsiveness and encouragement of children's independence and self-help skills, and lower levels of punitiveness and detachment.

The Early Childhood Environment Rating Scale-Revised (ECERS-R; Harms, Clifford, & Cryer, 2005), a global rating of classroom quality, contained 37 items coded on a 7-point scale, with a score of 1 representing "inadequate," a score of 3 representing "minimal quality," a score of 5 representing "good quality," and a score of 7 representing "excellent quality." Seven subscales from the ECERS-R were used in creating an overall mean score: (1) Personal Care Routines: greeting/departing, meals/snacks, nap/rest, toileting/diapering, health practices, and safety practices; (2) Furnishings: indoor space; furniture for routine care, play, and learning; furniture for relaxation and comfort; and room arrangement for play; (3) Language Skills: books and pictures, encouraging children to communicate, using language to develop reasoning skills, and informal use of language; (4) Motor Skills: space for gross motor play and equipment, fine motor activities, and supervision of gross motor activities; (5) Creativity: child-related display, art, music/movement, blocks, sand/water, and dramatic play; (6) Social Skills: discipline, staff-child interactions, and interactions among children; and (7) Program Structure: space for privacy, schedule, free play, and group time. In addition, teacher education level (i.e., less than college, Associate's degree, Bachelor's degree, or graduate degree) and years of experience were included. Finally, classroom level parent involvement was also included in the model, by taking the mean of parent responses on the measure of involvement in Head Start activities (described above) across children in a given classroom.

2. Data analyses

The FACES dataset is based on a complex sampling design, thus accommodations were made in the analyses to ensure results were representative of the population of Head Start children. To address the complex sampling design for the analyses conducted using SAS Proc Survey and SPSS Complex Samples, Taylor Series linearization was used applying the appropriate child base weight, strata, and cluster variables. For analyses conducted using HLM software, variance estimation due to the stratification and clustering in the sampling design is addressed through the within and between partitioning of variation in the multilevel model (Heck & Mahoe, 2004; Muthén & Satorra, 1995). To address disproportionate sampling, the fall 2000–spring 2001 longitudinal child and classroom weights were applied.

2.1. Establishing national profiles of school readiness for Head Start children

The primary goal here was to determine whether meaningful typologies of children's preacademic and social skills could be identified at the end of children's first Head Start year as at the beginning of their first Head Start year in a prior study (see McWayne et al., submitted for publication). Given that the number and scaling of variables entering a clustering algorithm influences their relative contributions in the final solution, all measures were balanced and standardized to the same *T* score metric ($M = 50$, $SD = 10$). A three-stage hierarchical clustering process was applied, with replication and relocation (McDermott, 1998). Children from spring 2001 were randomly and equally assigned to two mutually exclusive blocks, and, for each block, the ideal number of clusters was determined by: (a) an atypical decrease in overall between-cluster variance (r^2) and increase in within-cluster variance (Ward, 1963) and (b) a simultaneous elevation of the psuedo-*F* statistic (Calinski & Harabasz, 1974) over the psuedo-t^2 statistic (Duda & Hart, 1973). (*Note*: Psuedo-*F* indicates separation among all clusters at the current step, whereas pseudo t^2 indicates separation of the two clusters immediately joined at the current step.) Clusters derived from the two independent first-stage analyses were pooled and subjected to second-stage clustering. Since agglomerative clustering provides no natural mechanism to relocate retrospectively misplaced profiles, third-stage clustering applied divisive *k*-means iteration (as advised by Scheibler & Schneider, 1985) to relocate misplaced profiles.

To determine the internal validity of the profiles, selection criteria for second- and third-stage clustering were identical to those in first-stage clustering, and stopping rules were also applied: (a) the average within-cluster homogeneity coefficient, *H* (Tryon & Bailey, 1970) was $\geq$.60; (b) the average between-cluster similarity coefficient, R_P (Cattell, 1949), was $\leq$.40; (c) each final cluster replicated 100% as verified by absorption of the first stage-cluster into the same second- and third-stage cluster (as per Overall & Magee, 1992); and (d) the solution made psychological sense in terms of parsimonious coverage of the data. Cluster analyses were conducted in SAS 9.1 using the megaclustering macro developed by McDermott (MEG, 1998).

2.2. Examining relations of profiles to external variables

Once internal validity of these profiles was determined, their relationships to child and family demographics, as well as concurrent (Head Start) and later (kindergarten) school readiness variables were examined to determine the external validity of the profiles. First determined was whether children's profiles differentially related to child demographics (age, sex, race/ethnicity, ELL and disability status). For the continuous variable of child age, the General Linear Model (GLM) analysis within the Complex Samples mode of SPSS 17.0 was employed. The alpha level was adjusted for the number of comparisons via the Bonferroni correction. Because there is no provision for performing post hoc testing of every possible group contrast (e.g., Tukey's HSD) within this program, differences among specific groups were assumed if the confidence intervals did not overlap, representing a conservative approach (see Schenker & Gentleman, 2001). To determine whether profiles related differentially to the categorical demographic variables (i.e., child sex, race/ethnicity, disability and ELL status), two-tailed tests of the standard error of proportional differences were applied (Ferguson & Takane, 1989). Interpretable prevalence trends for each profile were based on statistically significant departures from overall sample expectancy. Again, the Bonferroni correction procedure was employed to control for the rate of Type I error. These analyses were conducted using PROC SURVEY in SAS 9.1. Next, contrasts between profiles were conducted to determine whether patterns of children's school readiness related differentially to concurrent school readiness indicators and end of kindergarten outcomes. These analyses were conducted, adjusting for child age, in the manner described above.

2.3. Investigating evidence of profile stability and/or change

Once it was determined that reliable profiles could be identified at the end of children's first Head Start year (spring 2001), these profiles were compared to those derived at the beginning of children's first Head Start year in Fall 2000 (see McWayne et al., submitted for publication). To address the issue of stability or change over time, profiles formed separately at the two time points were compared qualitatively. *Structural* stability was demonstrated if the two cluster solutions derived at the different time points were essentially identical (i.e., if clusters at Time 1 reproduced at Time 2). With respect to *individual* stability or change, the issue was whether or not individuals in one cluster at one time point reemerged in a qualitatively similar or qualitatively different cluster at another time point. Change of cluster membership was determined by performing exact tests on single cells in two-way contingency tables by using hypergeometric probabilities (Bergman & Trost, 2006), correcting for the mass significance problem (see Bergman et al., 2003). For this purpose, the EXACON module in SLEIPNER was used (Bergman & El-Khouri, 2002).

2.4. Investigating predictors of profile stability and change

A series of two-level hierarchical multinomial or binary logistic models (using HLM v. 6.06) were used to estimate profile membership in spring of children's first year in Head Start (referred to as Time 2) given their Fall 2000 (Time-1) profile membership. Thus, five separate two-level models were analyzed representing each of the five Time-1 profiles. Predictors included in the models were child and family attributes and parent/teacher/classroom context variables. The three multilevel multinomial logistic models were conducted with the following Time-1 profiles: 'Average'; 'High behavior problems at home, average social and academic', and 'High social, average academic.' Multilevel binary logistic models were conducted for two Time-1 Profiles 'high behavior problems at school, low social and academic' and 'high academic, average social' because of the small sample sizes in the Time 2 cross-tabulated cells ($n = 11$, 'high-average;' $n = 15$, 'high behavior problems,' respectively). In other words, too few children to analyze followed these unlikely paths. In each case, the reference category was the poorer performing Profile ('high behavior problems, low-average' and 'average,' respectively). Due to space limitations, technical details on these models are presented in the supplemental online materials under Appendix B.

The five logistic regression analyses were conducted in three steps. First, we examined an unconditional random intercept model which contained no predictors at level 1 or 2. The variation in children's profiles at Time 2 was assessed in the following ways: (1) the odds ratios for the included profile(s) as compared to the reference profile and (2) the variance component for each logit (τ_{00}), estimating the extent to which the odds varied across the population of Head Start classrooms. Next, a model was estimated that included only child and parent attributes (level-1). Third, a two-level contextual model was computed allowing for the examination of teacher and classroom prediction of Time-2 profiles. All analyses were performed using full maximum likelihood estimation. All level-1 and level-2 predictors were grand mean centered, such that coefficients could be interpreted controlling for all other predictors in the model. The intercepts were modeled as randomly varying. Statistical significance was determined by odds ratio confidence intervals that did not overlap with 1.00.

3. Results

3.1. Establishing national patterns of school readiness for Head Start children

At the end of children's first Head Start year (Spring 2001, Time 2), a three-profile solution met all stated criteria. The three profiles replicated 100% over first- through third-stage clustering and demonstrated strong psychometric properties. Homogeneity coefficients (H) ranged from 0.59 to 0.69 over profiles, with an overall grand homogeneity of 0.65. Similarity coefficients indicated that the profiles were sufficiently distinct from one other (with values ranging from 0.12 to 0.39). In addition, this three-profile solution accounted for 55% of the total variance. Table 1 shows the

Table 1
Readiness Mean Score Patterns (Standard Deviations), psychometric properties, and demographic variables of Spring 2001 (Time-2) core profiles.

Profile types	Profile 1: High-average	Profile 2: High Behavioral Problems, Low-Average Academic Skills	Profile 3: Average
Readiness variables			
Social Skills	56(.5)	40(.4)	54(.3)
Behavior Problems (Teacher)	45(.4)	59(.5)	45(.3)
Behavior Problems (Parent)	47(.3)	54(.5)	48(.5)
General Cognitive	58(.5)	41(.3)	51(.4)
Numeracy	59(.3)	44(.5)	48(.4)
Literacy	60(.5)	45(.4)	46(.3)
Psychometric properties			
Prevalence[b]	31%	31%	38%
Independent replication across two random blocks	100%	100%	100%
Internal profile cohesion (H)	.68	.59	.68
External isolation (R_P)	.19	.12	.39
Child demographics variables			
Child age in months[a]	52.1	45.9	47.3
Child gender[b]			
Girls	**56.3%**	*41.1%*	**51.9%**
Boys	*43.7%*	**58.9%**	*48.1%*
Child race[b]			
White	**61.2%**	*48.7%*	*52.7%*
Other	*38.8%*	**51.3%**	**47.3%**
Disability[b]	*11.3%*	**21.0%**	*11.9%*
Assessment in Spanish[b]	*8.0%*	**18.9%**	**22.3%**

Note: Means rounded to the nearest whole number.

[a] ANOVA results for age are presented within the text.

[b] Weighted percentages within a given profile type. Boldface type indicates that, according to two-tailed tests of the standard error of proportional differences, one group was disproportionately *overrepresented* in a given profile on the basis of sample expectancy. Conversely, italicized numbers signify that a group was *underrepresented* on the basis of expected sample proportions.

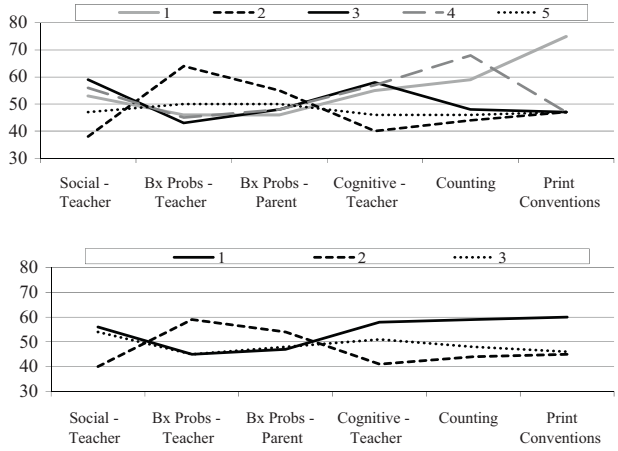

Fig. 1. National profiles of school readiness skills for Head Start children at two time points (Fall 2000 and Spring 2001). Fall 2000 Profiles (Time-1) – Profile 1: Average; Profile 2: High Behavioral Problems (Teacher), Low Social and Academic Skills; Profile 3: High Behavioral Problems (Parent); Profile 4: High Social Skills; Profile 5: High Academic Skills. Spring 2001 Profiles (Time-2) - Profile 1: High-average; Profile 2: High Behavioral Problems (Parent and Teacher), Low-Average Academic Skills; Profile 3: Average. Scores represent mean *T*-scores on the respective variables ($M = 50$, $SD = 10$).

characteristic mean *T*-score profile, as well as information pertaining to child demographic factors, discussed in more detail below. Fig. 1 provides a visual depiction of the patterns of school readiness at Time 1 (from McWayne et al., submitted for publication) and Time 2.

Profile names were derived from the patterns of dips and rises that reflect the relative strengths and weaknesses across preacademic and social functioning domains that characterize children in Head Start. Profiles are named according to the feature(s) of functioning that appears to distinguish it from the other groups and, thus, by implication, if not mentioned, profiles reflect average functioning in other domains. Analyses yielded a significant main effect for child age [Wald F (2, 30) = 86.6, $p < .0001$] that accounted for 14.3% of the difference between profile groups. These results and those for the categorical demographic variables are included below.

Profile 1: High average social and academic skills (prevalence = 31%): This pattern was marked by high-average teacher ratings across social and cognitive domains as well as high scores on independent assessments of emergent literacy and numeracy. Children in this profile were statistically more likely to be older, English-speaking, White, and non-disabled girls.

Profile 2: High average behavior problems at school/low average social and academic skills (prevalence = 31%): This pattern was distinguished by very high ratings of teacher-reported behavior problems and concomitant low to low-average scores across preacademic measures. Children in this profile were statistically more likely to be younger, disabled, and ethnic and linguistic minority boys.

Profile 3: Average (prevalence = 38%): This profile demonstrated the highest prevalence rate at Time 2, as it did at Time 1 (see McWayne et al., submitted for publication). These children were statistically more likely to be English language learners, girls, non-disabled, and ethnic minority.

3.2. Concurrent Head Start and kindergarten adjustment of readiness groups

With respect to external criterion validity, results revealed that the profiles related differentially to concurrent and later child performance indicators. Statistically significant differences were observed on all outcomes in the expected directions (i.e., favoring children in the higher performing profiles overall). For brevity, these results are presented in Tables 2 and 3.

3.3. School readiness stability and change

These findings provided evidence for both structural stability, as well as structural change. With respect to change, hierarchical cluster analyses yielded three types at the end of children's first year in Head Start (Time 2) compared with the five types identified at the beginning of their first year (Time 1) (see McWayne et al., submitted for publication). However, these three types replicated generally the differentiation of children's skills across domains into groupings of high, average, and low performers. Individual stability and change analyses indicated that Head Start children overall were 1.3–2.4 times more likely than expected by chance to remain in a qualitatively similar profile type from the fall to the spring (representing approximately 64% of Head Start children), and movement between the highest performing profiles and lowest performing profiles was rare. There were six likely longitudinal streams within this national sample: (1) 40% of children who started out in the High Social, Average Academic profile at Time 1 remained in the High-average group at Time 2; whereas, (2) 52% of children in the High Social, Average Academic profile at Time 1 moved to the Average group across time; (3) the majority, or roughly 72% of children who started out in the High Academic, Average Social profile group at Time 1 remained in the High-average group at Time 2; (4) 48% of children who fell within the Average profile at Time 1 remained with the Average group at Time 2; (5) 40% of children in the profile characterized by High Behavior Problems at Home at Time 1 constituted the High Behavior Problems, Low/Low-Average Skills profile at Time 2; and, (6) nearly 72% of children in the High Behavior Problems at School profile at Time 1 remained in the High Behavior Problems profile at the end of their first Head Start year.

In addition, seven statistically significant longitudinal streams were noteworthy for their low probabilities. These seven paths constituted 20.5% (or one-fifth) of the national first year Head Start population. Relatively speaking, two of these paths represented the movement of more children than the others: (1) 21% of children who began in the Average group at Time 1 moved to the High-average group at Time 2 and (2) 22% of children moved from the High Academic, Average Social profile at Time 1 to the Average profile at Time 2. All other unlikely paths reflected the movement of less than 4% of total Head Start children. See Fig. 2 for a display of these results. More detailed weighted information concerning movement from Time-1 to Time-2 profiles can be found in the accompanying supplemental online materials under Appendix C. To summarize, there was evidence of both individual stability *and* change in profile membership across time.

3.4. Predictors of stability and change

To answer the final research question regarding what child, family, and classroom factors predicted individual stability or change across profiles from the beginning to the end of children's first Head Start year, multilevel multinomial or binary logistic regression analyses were conducted for each Time-1 Profile, representing five subgroups of the total population.

3.4.1. Unconditional models

The first step of the multilevel analyses was to estimate unconditional random intercept models to test the overall variation in odds for Time-2 profiles across the classrooms (for brevity, these results are not presented). Overall, the intercept variance components were not statistically significant across the Time-1 subgroup analyses, providing less evidence of variation between-classroom in the log odds for Time-2 profile membership. Given

Table 2
External validity of school readiness profiles with respect to concurrent indicators.

Time-2 profile types	Profile 1: High-average	Profile 2: High Behavioral Problems, Low-Average Academic Skills	Profile 3: Average
Concurrent variables			
WJ-III Applied Problems[a]	421.41_a	392.85_c	401.75_b
WJ-III L-W Identification[b]	372.62_a	354.63_c	358.64_b
PPVT-III Receptive Vocabulary[c]	77.16_a	64.59_c	67.32_b
Social Skills (Teacher)[d]	19.1_a	12.5_c	18.5_b
Social Skills (Parent)[e]	12.5_a	11.6_b	12.3_a

Note: Profiles with different subscripts are statistically significantly different from each other. All results are reported as adjusted weighted means, adjusted for children's age. The first four variables were analyzed using W ability scores, placing children of different ages on a common scale; the last two variables are reported mean raw scores.

[a] Adjusted Wald $F(2.7, 82.7) = 148.9$, $p < .0001$; R^2 with age = 28.3%; without age = 26.7%.
[b] Adjusted Wald $F(2.6, 79.5) = 93.7$, $p < .0001$; R^2 with age = 24.4%; without age = 23.7%.
[c] Adjusted Wald $F(2.7, 85.0) = 105.3$, $p < .0001$; R^2 with age = 27.0%; without age = 23.4%.
[d] Adjusted Wald $F(2.3, 70.7) = 313.6$, $p < .0001$; R^2 with age = 45.5%; without age = 45.4%.
[e] Adjusted Wald $F(2.5, 76.0) = 13.8$, $p < .0001$; R^2 with age = 3.6%; without age = 3.6%.

Table 3
External validity of school readiness profiles with respect to indicators in kindergarten.

Time-2 profile types	Profile 1: High-average	Profile 2: High Behavioral Problems, Low-Average Academic Skills	Profile 3: Average
Predictive variables			
TOLD Phonemic[a]	11.2_a	7.0_c	7.9_b
WJ-III Applied Problems[b]	449.9_a	436.4_c	441.4_b
General Knowledge[c]	28.8_a	21.5_c	23.4_b
Social Skills (Teacher)[d]	19.1_a	15.6_b	18.4_a
Problem Behaviors (Teacher)[e]	3.7_b	8.4_a	4.7_b
Problem Behaviors (Parent)[f]	8.6_b	11.0_a	9.3_b

Note: Profiles with different subscripts are statistically significantly different from each other. All results are reported as adjusted weighted means, adjusted for children's age. The Applied Problems outcome score is based on W ability scores, placing children of different ages on a common scale; the remaining variables are reported as mean raw scores.

[a] Adjusted Wald $F(2.8, 85.4) = 40.1$, $p < .0001$; R^2 with age = 10.1%; without age = 9.6%.
[b] Adjusted Wald $F(1.9, 59.8) = 45.2$, $p < .0001$; R^2 with age = 10.6%; without age = 10.2%.
[c] Adjusted Wald $F(2.5, 76.5) = 40.7$, $p < .0001$; R^2 with age = 12.0%; without age = 11.2%.
[d] Adjusted Wald $F(2.4, 74.2) = 31.1$, $p < .0001$; R^2 with age = 9.0%; without age = 8.1%.
[e] Adjusted Wald $F(2.7, 83.9) = 54.1$, $p < .0001$; R^2 with age = 12.9%; without age = 12.2%.
[f] Adjusted Wald $F(2.1, 64.9) = 9.1$, $p < .0001$; R^2 with age = 3.0%; without age = 2.6%.

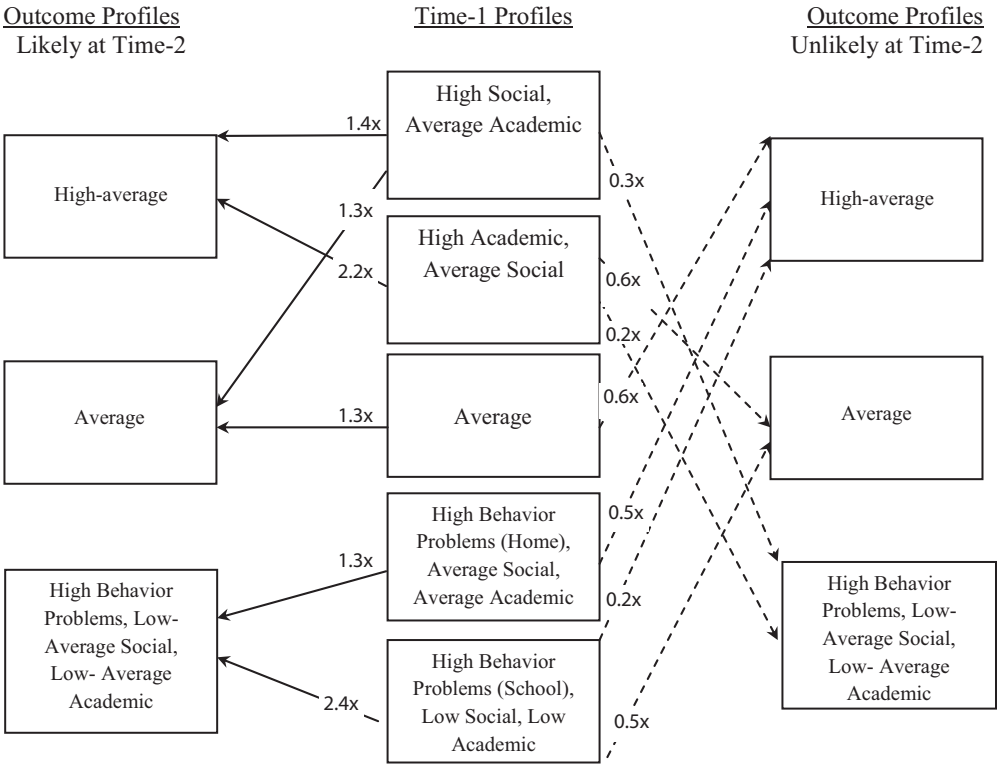

Fig. 2. Significantly likely and unlikely longitudinal streams across the first Head Start year. *Note:* Numbers represent the statistical likelihood of movement from Time 1 (Fall 2000) to Time 2 (Spring 2001). Ratios of observed frequencies to expected frequencies are given only for statistically significant longitudinal streams where 1.0 equals a chance distribution.

the lack of research examining differences in profile membership based upon classroom context, coupled with previous literature that supports between-teacher variance in reports of children's skills (e.g., McDermott et al., 2009), further analyses were warranted. Two additional points confirmed the need for modeling beyond the unconditional models: (1) residual variance decreased when level-1 and level-2 predictors were included in the model and (2) statistically significant variance components were found in preliminary analyses (not presented here) which modeled predicting Time-2 profiles given Time-1 profiles and child/parent/teacher covariates.

3.4.2. Level-1 models

The second step was to examine Time-2 profile membership strictly as a function of the level-1 predictors (i.e., child and parent covariates). Again, for brevity, these results are not presented. Examination of the variance components suggested that the addition of level-1 predictors, compared with the unconditional models, reduced the level-1 residual variance an average of 97%, indicating improved model fit.

3.4.3. Contextual models

Next, two-level contextual models were created that allowed the examination of child, teacher, and classroom influences on Time-2 profile membership given each of the Time-1 profiles. The variance component for the random intercept contextual models decreased by an average of about 62% (as compared to the level-1 models). These final model results are presented in Table 4 and the odds ratios are summarized below. The bolded values in the table represent statistically significant parameter estimates. Due to space limitations, weighted means and standard errors of context variables can be found within the accompanying supplemental online materials under Table 5.

Time-1 'average' subgroup: Examining only those children who were identified as 'average' at Time 1, the odds are decreased by about 38% that children will be 'high-average' (i.e., a 'better' profile) at Time 2 relative to an unlikely profile, 'high behavior problems, low-average' (i.e., a 'worse' profile) at Time 2, controlling for all else in the model (Table 4, row 1, column 1). Additionally, the odds at Time 2 for being 'high-average' (i.e., a 'better' profile) relative to an unlikely profile, 'high behavior problems, low-average' (i.e., a 'worse' profile) are increased: (a) about 14% for every one month increase in age (row 9, column 1); (b) approximately 14% for every one additional unit increase in parent involvement in Head Start (row 23, column 1). The odds for being 'high-average' ('better' profile) relative to an unlikely profile, 'high behavior problems, low-average' ('worse' profile) are decreased: (a) about 20% for every one additional point increase in the average classroom parent involvement in Head Start (row 8, column 1); (b) 58% for children who are in single-parent homes (relative to a mother-father or other mother-male home) (row 16, column 1); and (c) 57% for children whose mother earned less than a high school diploma or GED (relative to children whose mother earned a high school diploma or GED) (row 18, column 1). Examining only those children who were identified as 'average' at Time 1, the odds are increased by about 73% that children will be 'average' at Time 2 (i.e., a 'comparable' profile) relative to an unlikely profile, 'high behavior problems, low-average' (i.e., a 'worse' profile) (row 1, column 2), controlling for all else in the model. The odds for being 'average' at Time 2 (relative to an unlikely profile, 'high behavior problems, low-average') decrease by about 39% for every one additional point in parent's authoritarian parenting style (row 22, column 2).

Time-1 'high behavior problems at school, low social and academic' subgroup: Examining only those children who were identified as 'high behavior problems at school, low social and academic' at Time 1, the odds are decreased by 79% that children will be 'average' (i.e., a 'better' profile) at Time 2 rather than to belong to the 'high behavior problems, low-average' group (i.e., a 'comparable' profile), controlling for all else in the model (row 1, column 3). However, children who are instructed by teachers with less than some college (relative to children instructed by teachers with an associate's degree) have odds 7 times greater for being 'average' at Time 2 (relative to a likely path, 'high behavior problems, low-average') (row 5, column 3). Likewise, the odds of 'average' profile membership relative to the likely path, 'high behavior problems, low-average,' increase nine-fold for children who are flagged as Spanish-speaking at the beginning of the year (row 11, column 3). Due to the small number of children in this subgroup who end up in the 'high-average' Time-2 profile, further analyses were precluded.

Time-1 'high behavior problems at home, average social and academic' subgroup: Children identified as 'high behavior problems at home, average social and academic' at Time 1, have decreased odds of about 91% of being in the 'high-average' profile (i.e., the 'better' profile) at Time 2 relative to the more likely path, 'high behavior problems, low-average' (i.e., a somewhat 'comparable' profile) controlling for all else in the model (row 1, column 4). However, the odds for being 'high-average' (i.e., 'better' profile) relative to the likely path 'high behavior problems, low-average' (i.e., 'comparable' profile) at Time 2 are increased: (a) nearly 6-1/2 times for children whose teachers held a bachelor's degree (relative to an associate's degree/some college) (row 6 column 4); b) about 6-1/10 times for children whose teachers attended graduate school or held a graduate degree (relative to an associate's degree/some college) (row 7 column 4); (c) about 32% for every one point increase in the mean classroom parent involvement (row 8 column 4); and (d) 9% for every one month increase in age (row 9 column 4). The odds for being 'high-average' ('better') relative to the likely path, 'high behavior problems, low-average' ('comparable') are decreased about 78% for children in single-parent homes (row 16 column 4) and 74% for children in mother–grandmother or other non-mother-male homes (relative to children in mother–father or other mother-male homes) (row 17, column 4).

The odds for being 'average' ('better') at Time 2 relative to the likely path, 'high behavior problems, low-average' ('comparable') are increased: (a) about 7% for every one month increase in age (row 9, column 5) and (b) 13% for every one additional unit increase in parent Involvement in Head Start (row 23, column 5). The odds for being 'average' at Time 2 relative to the likely path, 'high behavior problems, low-average' are decreased about 60% for children in single-parent homes (row 16, column 5).

Time-1 'high social, average academic' subgroup: Examining only those children who were identified as 'high social, average academic' at Time 1, the odds for being 'high-average' (i.e., a 'better' profile) relative to an unlikely path, 'high behavior problems, low-average' (i.e., a 'worse' profile) are increased about 14-1/2 times, controlling for all else in the model (row 1, column 6). Additionally, the odds for being 'high-average' ('better') relative to the unlikely path, 'high behavior problems, low-average' ('worse') are increased: (a) about 12% for every additional year of teaching experience (row 4, column 6); (b) about 16% for every additional month in age (row 9 column 6); (c) about 4-3/4 times for females (relative to males) (row 10 column 6) d) about 6-1/2 times for children whose mothers have some college or more (as compared to those with a high school degree) (row 19 column 6); and (e) by 20% for every one point increase in parent involvement in Head Start (row 23 column 6). The odds for being 'high-average' ('better') relative to an unlikely path, 'high behavior problems, low-average' ('worse') are decreased: (a) about 85% for Spanish-speaking children (relative to English-speaking children) (row 11 column 6); b) about 86% for Black children (relative to White children) (row 13, column 6).

Table 4
Multilevel multinomial and binary logistic regression: model estimates.

Time-1 profile subgroup→	Average		High Behavioral Problems (Teacher), Low Social, Low Cognitive	High Behavioral Problems (Parent)		High Social Skills		High Academic Skills
Time-2 profile outcome→	High-average[a] B(SE) Odds ratio	Average[a] B(SE) Odds ratio	Average[a] B(SE) Odds ratio	High-average[a] B(SE) Odds ratio	Average[a] B(SE) Odds ratio	High-average[a] B(SE) Odds ratio	Average[a] B(SE) Odds ratio	High-average[b] B(SE) Odds ratio
Intercept	−**.49 (.18)**	**.55 (.14)**	−**1.58 (.23)**	−**1.67 (.41)**	−.04 (.21)	**2.68 (.50)**	**3.14 (.47)**	**1.35(.18)**
(β_{0j}) (γ_{00})	**.62**	**1.73**	**.21**	**.19**	.96	**14.57**	**23.21**	**3.85**
Arnett	.03 (.02)	−.00 (.02)	.02 (.02)	−.01 (.02)	−.02 (.02)	.06 (.05)	.03 (.03)	.02 (.02)
(γ_{01})	1.03	1.00	1.02	.99	.96	1.06	1.03	3.85
ECERS' mean	−.17 (.25)	.35 (.20)	.07 (.29)	−.24 (.32)	.41 (.31)	.23 (.53)	.11 (.42)	−.17 (.27)
(γ_{02})	.84	1.42	1.07	.87	1.51	1.26	1.12	1.02
Years teaching experience (γ_{03})	.01 (.02)	.01 (.01)	.00 (.02)	.06 (.03)	.00 (.03)	**.11 (.04)**	**.11 (.04)**	.01 (.02)
	1.00	1.10	1.00	1.06	1.00	**1.12**	**1.11**	1.01
Teacher education: less than some college[c] (γ_{04})	.38 (.55)	.34 (.54)	**1.91 (.48)**	−2.06 (1.24)	.47 (.65)	−1.03 (.987)	−.66 (.68)	.63 (.73)
	1.46	1.40	**6.78**	.13	1.61	.36	.52	1.88
Teacher education: bachelor's degree[c] (γ_{05})	.17 (.41)	.10 (.35)	−.49 (.70)	**1.86 (.77)**	−.03 (.67)	−.26 (.94)	.001 (.82)	−.02 (.42)
	1.18	1.11	.61	**6.41**	.97	.77	1.00	.98
Teacher education: graduate school or greater[c] (γ_{06})	.49 (.49)	.31 (.37)	1.02 (.54)	**1.80 (.64)**	.61 (.60)	−1.58 (.97)	−1.01 (.72)	.40 (.56)
	.81	1.36	2.77	**6.07**	1.840	.21	.36	1.50
Mean classroom parent involvement in Head Start (γ_{07})	−**.22 (.10)**	−.06 (.08)	.11 (.11)	**.27 (.13)**	.01 (.11)	−.15 (.160)	−.08 (.13)	.09 (.10)
	.81	.94	1.12	**1.32**	1.01	.86	.92	1.09
Age in months (β_{1j}) (γ_{10})	**.13 (.03)**	.04 (.03)	.07 (.04)	**.09 (.04)**	**.07 (.03)**	**.15 (.07)**	.04 (.07)	**.13 (.03)**
	1.14	1.05	1.07	**1.09**	**1.07**	**1.16**	1.04	**1.14**
Female[d]	.53 (.34)	.46 (.30)	.03 (.42)	.20 (.56)	.06 (.35)	**1.56 (.58)**	**1.23 (.46)**	.55 (.32)
(β_{2j}) (γ_{20})	1.70	1.59	1.03	1.22	1.06	**4.76**	**3.42**	1.74
Spanish assessment flag[e]	−.81 (.63)	.46 (.30)	**2.21 (.94)**	−1.33 (.95)	−.29 (.65)	−**1.89 (.83)**	−.09 (.79)	.03 (.75)
(β_{3j}) (γ_{30})	.44	.95	**9.15**	.26	.75	**.15**	.92	1.03
Disabled[f]	−.03 (.53)	.04 (.45)	−.40 (.55)	−.95 (.67)	−.51 (.43)	−1.66 (.89)	−1.11 (.85)	−.26 (.56)
(β_{4j}) (γ_{40})	.97	1.04	.67	.39	.60	.19	.33	.77
Black[g]	.02 (.48)	.32 (.39)	−.32 (.53)	−.54 (.65)	.79 (.52)	−**1.96 (.91)**	−1.01 (.73)	−.48 (.48)
(β_{5j}) (γ_{50})	1.02	1.38	.73	.58	2.19	**.14**	.36	.62
Hispanic[g]	−.005 (.52)	−.18 (.40)	−1.82 (.94)	.03 (.75)	.520 (.51)	−.40 (.75)	−.32 (.73)	−.74 (.51)
(β_{6j}) (γ_{60})	1.00	.84	.16	1.03	1.68	.67	.73	.48
Other non-white race[g]	−.77 (1.05)	.02 (.61)	−.61 (1.04)	NA	NA	−1.75 (1.40)	−.76 (1.31)	−1.6 (1.04)
(β_{7j}) (γ_{70})	.46	1.02	.54			.17	.47	.21
Family structure: single parent [h]	−**.86 (.42)**	−.55 (.30)	−.52 (.48)	−**1.49 (.73)**	**-.91 (.37)**	2.23 (1.19)	2.03 (1.15)	.39 (.47)
(β_{8j}) (γ_{80})	**.42**	.58	.59	**.23**	**.40**	9.30	7.62	1.47
Family structure: mother-grandm or other non-mother-male[h]	−.08 (.51)	−.63 (.45)	−.66 (.63)	−**1.49 (.72)**	−.15 (.57)	−.09 (.84)	.42 (.68)	.04 (.58)
(β_{9j}) (γ_{90})	.92	.53	.52	**.26**	.86	.92	1.52	1.04
Mother's education: less than high school[i]	−**.84 (.38)**	−.16 (.27)	−.76 (.48)	−.58 (.70)	−.83 (.42)	−.48 (.77)	.04 (.65)	−.38 (.40)

Table 4 (*Continued*)

Time-1 profile subgroup→	Average		High Behavioral Problems (Teacher), Low Social, Low Cognitive	High Behavioral Problems (Parent)		High Social Skills		High Academic Skills
Time-2 profile outcome→	High-average[a] B(SE) Odds ratio	Average[a] B(SE) Odds ratio	Average[a] B(SE) Odds ratio	High-average[a] B(SE) Odds ratio	Average[a] B(SE) Odds ratio	High-average[a] B(SE) Odds ratio	Average[a] B(SE) Odds ratio	High-average[b] B(SE) Odds ratio
$(\beta_{10j})(\gamma_{100})$	.43	.86	.47	.56	.44	.62	1.04	.68
Mother's education: some college or more[i]	−.39 (.40)	−.54 (.31)	−.43 (.53)	.32 (.59)	−1.04 (.53)	**1.88 (.93)**	1.01 (.89)	.12 (.40)
$(\beta_{11j})(\gamma_{110})$	.68	.58	.65	1.37	.35	6.55	2.74	1.12
Home activities	.05 (.05)	.03 (.04)	.03 (.05)	.00 (.08)	−.02 (.32)	.04 (.08)	.04 (.08)	.02 (.05)
$(\beta_{12j})(\gamma_{120})$	1.05	1.03	1.03	1.00	.98	1.04	1.04	1.02
Authoritative	.18 (.27)	.32 (.25)	−.03 (.33)	.48, .51)	−.29 (.32)	−.26 (.52)	−.60 (.52)	−.04 (.29)
$(\beta_{13j})(\gamma_{130})$	1.18	1.37	.97	1.62	.75	.77	.55	.96
Authoritarian	−.33 (.28)	**−.50 (.22)**	.25 (.25)	.29 (.40)	.16 (.261)	.05 (.45)	−.20 (.40)	−.01 (.28)
$(\beta_{14j})(\gamma_{140})$	.72	**.61**	1.28	1.34	1.18	1.05	.82	.99
Parental involvement in Head Start	**.13 (.05)**	.04 (.04)	.05 (.06)	.06 (.09)	**.12 (.05)**	**.19 (.07)**	.09 (.07)	.01 (.06)
$(\beta_{15j})(\gamma_{150})$	**1.14**	1.04	1.05	1.06	**1.13**	**1.20**	1.09	1.01

Random effects	Variance (*df*) [χ^2]	Variance (*df*) [χ^2]	Variance (*df*) [χ^2]	Variance (*df*) [χ^2]	Variance (*df*) [χ^2]	Variance (*df*) [χ^2]	Variance (*df*) [χ^2]	Variance (*df*) [χ^2]
Contextual models								
Intercept (τ_{00})	.36 (179) [153.38] $p > .50$	.03 (179) [170.08] $p > .50$	.00 (123) [155.30] $p = .026$	.44 (120) [165.72] $p = .004$	.85 (119) [155.07] $p = .015$	2.63 (132) [104.45] $p > .500$	.27 (133) [84.93] $p > .500$	.33 (46) [147.52] $p = .45$
Level 1 models								
Intercept (τ_{00})	.43 (186) [151.41]	.14 (186) [174.10]	.50 (130) [144.08]	.79 (127) [124.24]	.97 (127) [151.05]	3.00 (141) [102.33]	.38 (141) [89.15]	.36 (153) [150.73]
Unconditional models								
Intercept (τ_{00})	.68 (186) [170.34]	.19 (186) [180.83]	.39 (130) [136.24]	.91 (127) [126.53]	1.00 (127) [155.13]	2.19 (141) [118.96]	.46 (141) [101.00]	

Note. Boldface type indicates statistically significant odds ratios that do not overlap with 1.00.

[a] Reference group is 'high behavior problems, low-average'.

[b] Reference group is 'average'.

[c] Reference group is 'associate's degree or some college'.

[d] Reference group is 'male'.

[e] Reference group is non-Spanish flagged assessment.

[f] Reference group is non-disabled.

[g] Reference group is White.

[h] Reference group is mother-male household.

[i] Reference group is high school diploma or GED.

The odds of being in the 'average' profile (i.e., a 'comparable' profile) at Time 2 relative to the 'high behavior problems, low-average' (i.e., 'worse') profile are 23 times greater controlling for all else in the model (row 1, column 7). Additionally, the odds for being 'average' relative to an unlikely path, 'high behavior problems, low-average,' are increased: (a) about 11% for every additional year of teaching experience (row 4, column 7) and (b) about 3-1/2 times for females (relative to males) (row 10, column 7).

Time-1 'high academic, average social' subgroup: Examining only those children who were identified as 'high academic, average social' at Time 1, the odds are 3-3/4 times greater for being 'high-average' (i.e., a 'comparable' profile) as compared to 'average' (i.e., a 'worse' profile) at Time 2, controlling for all else in the model (row 1, column 8). Additionally, the odds for being 'high-average' as compared to 'average' at Time 2 are about 14% greater for every one month increase in age (row 9, column 8). Due to the small sample size for the 'high behavior problems, low-average' Time-2 profile membership for this subgroup, these cases were not able to be included.

4. Discussion

This study is the first to examine profiles of children's school readiness skills and their stability and change over time with a nationally representative Head Start sample. Results suggested that as children complete their first year of Head Start, reliable intraindividual patterns of children's readiness skills can be identified, reflecting qualitatively distinct groups of children, and that these profiles demonstrate internal validity and meaningful relationships with both concurrent and later readiness performance indicators. This study also demonstrated that while the majority of children (~80%) remained in a similar profile type across the Head Start year, a substantial proportion (~20%) evidenced changing configurations of strengths and needs over time, representing both improvements and declines in functioning. Thus, a primary strength of this study over existing person-oriented school readiness studies to date is that it documented the malleability of school readiness skills and identified factors that predicted stability and change with a population-based sample of low-income children. Results suggested that child characteristics (i.e., age, sex, race, ELL status), parent characteristics (i.e., maternal education, family structure, parenting style, and parent involvement in Head Start), and classroom factors (i.e., teacher education, teacher experience, mean classroom parent involvement) predicted this stability and change, with children's ELL status, ethnicity, teacher education, and maternal education exhibiting the relatively strongest relationships.

With respect to *structural* stability and change, Time-1 patterns replicated generally at Time 2 (i.e., representing low average performers, average performers, and high average performers), but Time-2 profiles were fewer than those found at Time 1. Perhaps this reflects less differentiation among children's social skill configurations (e.g., social skills vary less across home or school contexts over time) or more agreement between reporters (i.e., parents and teachers) as children develop across the Head Start year. In terms of *individual* stability and change, likely and unlikely longitudinal paths were identified, with one-fifth of students following probabilistically unlikely paths. This finding contrasts with person-oriented investigations of older children, where unlikely paths account for a much smaller proportion of the overall sample (e.g., Laursen et al., 2006), supporting the notion that development is quite dynamic during early childhood.

Several child, family, and classroom characteristics were significant in helping to explain this stability and change, in the expected directions, with a few exceptions. With respect to child-level protective factors, being older and female tended to predict movement to a higher performing profile over time or stability within an already average or high-average performing profile. This suggests that a portion of the presumed growth across the Head Start year is developmental as one would expect. Additionally, being an English language learner was both a risk and protective factor, depending on the profile at Time 1. If an ELL child was in the lowest performing group at the beginning of the year, s/he had higher odds of moving to a higher performing profile than staying within the lowest performing group across time (compared to non-ELL children). This finding is consistent with other Head Start research showing ELL children benefit more from intervention than their non-ELL peers (U.S. DHHS ACF OPRE, 2010). However, being ELL and Black (as opposed to White) decreased a child's (with high-average social skills but average preacademic skills) odds of moving to the highest performing profile. Again, this seems to support that, at least for some ethnic and linguistic minority children, social skills do little to promote academic skills when these skills are already in the average range, adding more nuanced data to the Duncan et al. (2007) study with numerous national datasets. Clearly, more research is needed to understand this latter finding.

With respect to family risk and protection, among children who begin the year with average preacademic skills, if they have a mother with an authoritarian parenting style, lower level of education, or reside in a family other than one with a mother-male composition, they will likely remain within the average group or will be at-risk for moving to a lower performing group. Future research should explore other factors to explain these patterns, but these findings comport with prior research (e.g., Burchinal et al., 2002; Stevenson & Baker, 1987) identifying single parenthood, low maternal education, and harsh parenting as risks to child development. In contrast, as hypothesized, higher levels of maternal education served as a protective factor, promoting movement to higher performing profiles among those children starting out with average preacademic skills. Likewise, parent involvement in Head Start was found to be a significant protective factor, with children whose parents were involved in center-based activities also being more likely to move from an average preacademic profile to the high preacademic profile. This finding corroborates the large body of work suggesting family involvement in children's education is an important contributor to school success (Ginsburg-Block, Manz, & McWayne, 2010; Jeynes, 2003) and contrasts with other studies, demonstrating that when family involvement and parenting style variables compete in the same regression model family involvement lacks a net effect (e.g., Zellman & Waterman, 1998). Interestingly, whereas in some studies, home-based involvement tends to out-predict school-based involvement (e.g., Fantuzzo, McWayne, Perry, & Childs, 2004), in this national study, when controlling for center-based activities, what parents reported doing with their children at home did not add substantially to the model. Future research will need to tease out reasons for this. However, it is plausible that poorer measurement of this construct or respondents' recall problems influenced these results. It is also worth mentioning, with respect to the parenting variables, that child evocative effects could be operating, such that children's skills influence their parents' involvement and parenting.

As expected, teacher characteristics also appear to have an impact on children's configuration of skills across time. Higher levels of teacher experience were associated with the movement of children with high social and average preacademic skills at the beginning of the year to the highest performing group by the end of the year, as well as those children who evidenced average social and preacademic skills but high behavior problems at home at the beginning of the year. In addition, teacher education promoted better school readiness across the year for this latter group. In contrast to expectations, however, having a teacher with only some college experience (compared to a teacher with an Associate's degree), served as a protective factor for children in the lowest performing

group at Time 1; these children were more likely to move to the average profile by the end of the year. Although this interaction was not specifically tested, it could be that, for this group, Head Start teachers without college degrees are those with the most experience. If this is indeed the case in this sample, it is plausible that despite not having a college degree, teachers with more experience may be better able to move the children most at-risk along. This likely represents a moment in Head Start history and might not hold into the future as the program emphasizes increasing credentialing of its teachers. Under the most recent Head Start Performance Standards, programs are expected to demonstrate progress toward meeting the mandate that every teacher possess at minimum an associates or baccalaureate degree (U.S. DHHS, 2008).

Furthermore, an inconsistent finding concerning classroom-level parent involvement was found. For children who at Time 1 were identified by their parents as having behavioral problems at home, higher levels of classroom parent involvement served as a protective factor, increasing these children's odds of ending up in the High-average profile at Time 2. Conversely, for children identified as Average at the beginning of Head Start, this classroom level of involvement decreased their odds of being in the High-average group relative to the Low-Average group at the end of the year. Although clearly speculative in nature, it is possible that for children who are performing in the average range at school but having behavior problems at home, this increased adult support in the classroom provides a compensatory benefit, but that it provides no additional benefit for children performing within the average range at school with no home-reported problems (see Watamura, Phillips, Morrissey, McCartney, & Bub, 2011 for a recent study of compensatory processes across child care and home settings).

Perhaps most surprising, and incongruent with our hypotheses, across children's first year in Head Start, other global measures of classroom quality had no association with profile stability and change. It could be that environmental quality and caregiver sensitivity, in the aggregate, are just too distal to compete with the more proximal variables. This is not to say that classroom quality is unimportant, just that relative to other child, teacher and family factors, it tends to be less important for Head Start children (Burchinal et al., 2002). Or, perhaps, more sensitive measures of classroom quality are needed. For example, the CLASS (Pianta, La Paro, & Hamre, 2008) shows particular promise in Head Start. With respect to caregiver sensitivity, it may be that measures of individual teacher–student interaction (rather than general sensitivity measures) are needed. Furthermore, recent research has documented that classroom quality factors become more influential later (Crosnoe et al., 2010), so longitudinal research with this group may detect stronger relations.

In conclusion, this study underscores the importance of viewing children's school readiness as both internally dynamic and influenced by external factors. Specifically, our findings demonstrated that children's mutable skills constitute distinct patterns of school readiness and that important features of the children themselves, their families, and their Head Start experience help to explain stability and change of their skills over time.

5. Limitations and qualifications

Qualifications of the present findings are warranted. First, this study was conducted with a Head Start sample, representing a very specific educational context for low-income children. These findings may not be generalizable to low-income children in other early care and education programs or representative of non-low-income populations. Despite this, it fulfilled a need in the literature for population-based studies of school readiness with a policy-relevant low-income group (Rouse & Fantuzzo, 2009).

Second, this study derived empirically based profiles of children's skills across two major developmental domains: social and cognitive. However, a whole-child perspective of school readiness encompasses more than these two domains, including children's physical/motor development, approaches to learning, artistic/creative skills, and health. As these domains do not develop in isolation from one another, future investigations should seek to understand more fully the construct of school readiness and how it changes over time (NRC, 2008).

Relatedly, there were relative strengths and weaknesses of the measures included in this study. Decisions were made to include reliable and valid child measures derived from multiple methods (direct assessment, behavior ratings, observation) as well as multiple informants (independent assessors, teachers, and parents). However, because many of the assessments were reliant on children's language ability in English, there were limited indicators to choose from in the FACES dataset that were able to be reliably administered in Spanish. The Woodcock-Johnson and Muñoz (as well as the PPVT and TVIP) test scores are not directly comparable (i.e., no metric or scalar equivalence, different norms); therefore, we chose to use these as criterion validity measures but not as a part of the profiles in order to retain a large ELL subgroup of children in our study. Study findings were also limited by the nature of the parenting measures. Although the Parent Involvement in Head Start scale was fairly comprehensive, measures of parenting style were not and suffered from lower reliabilities.

In terms of methods, there are some multilevel logistic subgroup analyses where the reference category had a smaller percentage of cases as compared to other categories. The selection of the reference category 'high behavior problems' was made for theoretical purposes (i.e., it made the most theoretical sense to compare the other profiles to the 'worst performing' profile), and, additionally, the sample size of this profile was substantial for three of the five Time-1 Profiles (approximately 30% or more). In the case of Time-1 Profiles 'high social skills' and 'high academic skills,' the estimated coefficient values *may* be less stable given the smaller percentage of cases in the reference category for these subgroups. To the extent possible, future research may wish to consider selecting a 'like' profile at the latter time point so that the results may be interpretable to movement to a dissimilar profile.

Finally, common criticisms of using person-oriented statistical approaches are relevant here. For example, roughly parallel profiles (as evidenced at Time 2) may indicate a single population with a relatively multivariate normal distribution of the clustering variables rather than indicate that multiple populations were sampled. If this is the case, some argue that important information about individual differences is lost by creating a categorical variable through the clustering procedure (Bauer & Shanahan, 2007). We concur with researchers such as Hair et al. (2006) who recognize caveats inherent in clustering procedures but who also state, "[cluster analysis] has the potential to reveal structures within the data that could not be discovered by other means" (p. 598). The taxonomies created through the clustering are helpful not only for segmentation but for simplification of the data as well as identification of relationships (Hair et al., 2006). An example of identification of relationships was evidenced in this study, where, for each Time-1 profile (rather than for the sample in aggregate), we were able to estimate the effects of child/parent/classroom covariates on movement to a likely or unlikely Time-2 profile.

6. Implications for early childhood practice and policy

Given that we have little understanding about what factors practice or policy may manipulate to improve school readiness, these findings shed light on what we may do to promote movement to a higher-performing profile or prevent movement to a poorer-performing profile. Firstly, important to the national discussion of school readiness is the finding that skill-based assessments formed

distinct profiles that explained significant variability in children's later academic and social adjustment. Researchers and practitioners alike maintain that assessment tools serve optimally when the information derived is based upon children's functioning within the natural classroom environment and not on isolated skills tested out of context (Hirsh-Pasek, Kochanoff, Newcombe, & de Villiers, 2005; Meisels, 1999). Skill-based dimensions were chosen for this study because they are observable by teachers and, thus, arguably more amenable to teachers' efforts to differentiate curricula for meeting children's needs. In other words, these things we can see and change. Indeed, there was clear evidence that these profiles were dynamic, with one-fifth of children moving to a qualitatively different profile across the school year.

Of particular note, ELL children who entered Head Start exhibiting high levels of behavior problems had the greatest odds of moving to a higher performing profile, all other things being equal. This is suggestive of the positive effect Head Start may have for these children. Conversely, ELL and African American children who came in with high levels of sociability are not as likely to improve their performance across time, suggesting a possible place to bolster intervention to build on the social strengths these children bring into the classroom. We assert that this within-group variability is particularly important to document for populations considered at-risk, in order to identify child, family, and classroom strengths that defy deficit-oriented expectations.

Furthermore, within the context of interventions such as Head Start, it is imperative that we understand those contextual aspects of children's experiences that can be changed and, therefore, may serve as points for greater intervention. This study indeed provided such information to inform future practice and policy. With respect to malleable context factors, findings concerning teacher education provide compelling evidence that, for the majority of children, having a teacher with a higher level of education is related to stability or improvement of school readiness skills across time. In addition, more years of teaching experience is protective for children who enter Head Start with a high degree of sociability, but average preacademic skills, suggesting that Head Start should capitalize on those teachers who can provide mentorship to less experienced teachers. For several groups of children, higher levels of parent involvement in Head Start meant that they were more likely to move to a higher performing profile across time. These findings suggest that Head Start should continue to build on its two-generational approach through parent involvement programming.

In addition, Head Start's two-generational focus provides opportunities for intervening with other factors (both malleable and less malleable in nature). A renewed attendance to equity is warranted with respect to inclusion of families considered more at-risk (e.g., those characterized by low maternal education and female-headed households). These findings also suggest that programming designed to improve parent–child interaction and maternal education could be worthwhile. Future researchers will need to continue to attend to the dynamic processes occurring during this developmental period to inform the best early childhood educational practices and most potent intervention efforts (as per Cairns & Rodkin, 1998).

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Appendix A. Study measures

Time point	Study variables	Measures	Reporter	Alpha reliability
Fall 2000 and Spring 2001	*Academic variables for profiles*			
	General Cognitive	COR	Teacher	.83
	Numeracy	Independent	Independent	.94
	Literacy	CAP	Independent	.75
	Social variables for profiles			
	Behavior Problems	PMS, CBCL, BPI	Teacher	.86
	Behavior Problems	PMS, CBCL, BPI	Parent	.75
	Cooperative Classroom Behaviors	PMS, SSRS	Teacher	.88
Spring 2001	*Concurrent criterion validity variables*			
	WJ-III Letter-Word Identification	WJ-III	Independent	.86
	WJ-III Applied Problems	WJ-III	Independent	.91
	PPVT-III receptive vocabulary	PPVT-III	Independent	.97
	Social Skills	COR	Teacher	.83
	Social Skills	COR	Parent	.62
Spring 2002/2003	*Predictive criterion validity variables*			
	Phonemic Analysis	TOLD	Independent	.96
	WJ-III Applied Problems	WJ-III	Independent	.88
	General Knowledge	ECLS-K	Independent	.77
	Social Skills	PMS, SSRS	Teacher	.88
	Problem Behaviors	PMS, CBCL, BPI	Teacher	.86
	Problem Behaviors	PMS, CBCL, BPI	Parent	.80
Spring 2001	*Context variables for MLM models*			
	Authoritative parenting style	NLSY, EHS, QRC	Parent	.50
	Authoritarian parenting style	NLSY, EHS, QRC	Parent	.60
	Parental home involvement	QRC	Parent	.69
	Parental involvement at Head Start	NHES	Parent	.79
	Classroom quality	ECERS-R mean	Independent	.92
	Caregiver sensitivity	CIS	Independent	.94

Note: BPI: Behavior Problems Index; CAP: Comprehensive Assessment Program Early Childhood Diagnostic Instrument; CBCL: Child Behavior Checklist for Preschool-Aged Children, Teacher and Parent Reports; CIS: Arnett Caregiver Interaction Scale; COR: Child Observation Record; ECERS-R: Early Childhood Environment Rating Scale – Revised; ECLS-K: Early Childhood Longitudinal Scale – Kindergarten; EHS: Early Head Start Evaluation; QRC: Head Start Quality Research Consortium; NHES: National Household Educational Survey; NLSY: National Longitudinal Survey of Youth; PMS: Personal Maturity Scale; PPVT-III: Peabody Picture Vocabulary Test; SSRS: Social Skills Rating System; TOLD: Test of Language Development; WJ-III: Woodcock-Johnson Psycho-Educational Battery.

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.ecresq.2011.10.002.

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