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Age of Entry to Kindergarten and Children's Academic Achievement and Socioemotional Development

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Abstract

Research Findings—Data on more than 900 children participating in the National Institute of Child Health and Human Development Study of Early Child Care were analyzed to examine the effect of age of entry to kindergarten on children's functioning in early elementary school. Children's academic achievement and socioemotional development were measured repeatedly from the age of 54 months through 3rd grade. With family background factors and experience in child care in the first 54 months of life controlled, hierarchical linear modeling (growth curve) analysis revealed that children who entered kindergarten at younger ages had higher (estimated) scores in kindergarten on the Woodcock-Johnson (W-J) Letter-Word Recognition subtest but received lower ratings from kindergarten teachers on Language and Literacy and Mathematical Thinking scales. Furthermore, children who entered kindergarten at older ages evinced greater increases over time on 4 W-J subtests (i.e., Letter-Word Recognition, Applied Problems, Memory for Sentences, Picture Vocabulary) and outperformed children who started kindergarten at younger ages on 2 W-J subtests in 3rd grade (i.e., Applied Problems, Picture Vocabulary). Age of entry proved unrelated to socioemotional functioning.

Practice—The fact that age-of-entry effects were small in magnitude and dwarfed by other aspects of children's family and child care experiences suggests that age at starting school should not be regarded as a major determinant of children's school achievement, but that it may merit consideration in context with other probably more important factors (e.g., child's behavior and abilities).

Perhaps no other issue appears so frequently and dominantly in parents' discussions of school readiness or school districts' readiness policies as that of the age at which children are eligible (or required) to start kindergarten. When parents are surveyed about their children's school readiness and enrollment, one of the most frequent questions noted is whether their child is too young to enroll (e.g., West, Hauske, & Collins, 1993). Kindergarten teachers identify age as a factor that figures prominently in definitions and beliefs about readiness for kindergarten, and age is often used as a post hoc explanation for decisions to retain children in kindergarten (National Center for Education Statistics [NCES], 1993a).

Age of entry to school is also of considerable policy importance (Meisels, 1992,1999). It is an index society uses as an eligibility or selection mechanism for access to public resources and, consequently, an index that triggers potential benefits of stimulation gained by attendance in school. Given that, within a 12-month year, older children tend to show more advanced developmental skills than younger children, changes in age of entry can have effects on the percentages of children who meet certain academic or skill standards and can boost a district's standing on certain metrics (Vecchiotti, 2001). In short, age of entry to school figures prominently in teacher and parent belief systems about children's school readiness, as well as in policy-related decision making about who secures the benefits of publicly funded education. In this study we examined variations in children's academic and social outcomes through third

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grade as a function of age of entry to school, as well as age-of-entry cutoffs used in many states. Of importance is the fact that we evaluated the effects of the age of entry after controlling for the children's prior experiences at home and in child care and their performance in academic and social functioning just prior to school entry. This advantage of our longitudinal design is not reflected in most research on this issue, yet it is critical for understanding the unique effect of age.

Trends in Entry Age

Exactly when children enroll in kindergarten varies around the world (Meisels, 1992). School entry is set at 6 in Russia, Switzerland, Australia, Japan, and Germany. In Sweden, children enter school at age 7, in England they begin school between 4 and 5 years of age, and in New Zealand children begin school on their fifth birthday, rather than on a specific uniform date in the fall. Although school entry also varies across the United States, with cutoff birth dates for enrollment typically set by the state, children in traditional American schools begin kindergarten at about age 5, placing the United States in the earlier portion of school-entry ages when compared with other countries. The modal cutoff date is the beginning of September, just about the time school begins (see Table 1 in Stipek, 2002). This is the date by which children must turn 5 if they are to enter kindergarten. During the past several decades there has been a trend toward making the cutoff date earlier, so that children enter kindergarten older on average than was once the case.

There has also been a trend for parents to delay children's kindergarten entry a year beyond the time a child is eligible to start school (Stipek, 2002). In fact, about 10% of American parents defer their children's kindergarten entry in such a manner (e.g., Brent, May, & Kundert, 1996; May, Kundert, & Brent, 1995; NCES, 1997), especially for sons (Bellisimo, Sacks, & Mergendoller, 1995; Brent et al., 1996; May et al., 1995). Children whose birthdays are closest to the cutoff, and thus who would be youngest at time of school entry (were they to begin school when the law permits), are most likely to be held back from kindergarten by parents (Cosden, Zimmer, & Tuss, 1993; May et al., 1995; NCES, 1997), a process known as *redshirting*.[1]

It is clear, despite both parents' and educators' manipulation of age of entry, that these attempts do little to attenuate the age (and skill-related) variation that exists within a given cohort of students enrolled in a given year (although the rate of redshirting can actually increase variation in a cohort). Thus, policies that move entry dates earlier or later, although they may change the average age and skill level in a cohort in the subsequent year, do not change variation in age or skill. Variation in children's skills is the challenge most often identified by kindergarten teachers as a barrier to effective teaching (Rimm-Kaufman et al., 1999; Vecchiotti, 2001).

Because manipulations of age of entry are predicated on an assumption that age and skill covary and that this association remains active over time, longitudinal examinations of the association between age and skill are critical for examining this assumption. The present article was targeted at examining the association between age of entry and a range of developing academic and social skills over the first 4 years of school, years that are foundational to debates about the relevance of age for later functioning. Pianta (2006) argued that both education and developmental science can be advanced through studies in which educational policies and practices (such as age of entry) are examined through a developmentally informed theoretical and methodological framework, such as was the case in the present study.

[1]The term *redshirting* derives from the practice in college sports of delaying when a new student begins playing for the varsity team and, in so doing, extending the time he or she is allowed to play under National Collegiate Athletic Association rules. Thus, a redshirted freshman is actually a second-year student (i.e., sophomore) who is playing on the varsity squad for the first time and still remains eligible to play for a full four years (i.e., into his or her fifth year of college.

Policy Context of Debates About School Entry Age

Recently, Stipek (2002) reviewed evidence pertaining to the question "At what age should children enter kindergarten?" and observed that the policy context in which this question is posed has changed rather dramatically over time. Whereas only a few decades ago this question was situated within debates about compulsory education laws and thus the age when it should be mandatory for children to attend school, today the common question for policymakers concerns the specific age at which children should be allowed to enter kindergarten.

According to Stipek (2002), the increasing emphasis on school accountability and thus on students' performance on achievement tests will likely encourage more states and districts to at least consider increasing the age of school entry. In 1999, California based a change in its law legislating the age at which children could start school partly on the argument that older children would be better prepared than younger children to get the most from the increasingly academic curriculum of kindergarten. In contrast to individuals who espouse maturationally oriented thinking that links age and ability (Frick, 1986; Uphoff & Gilmore, 1986), those who emphasize the role of experience in learning and development tend to be opposed to moves that deny younger children the chance to start school when they otherwise could. For these theorists, time in an instructional context is more important than additional biological maturation when considering children's capacity to benefit from schooling (Stipek, 2002). Furthermore, school attendance also functions as a mechanism for nonparental care of children that is publicly funded, and in this context access to such care (and its benefits) is viewed as particularly important for children from less advantaged homes where funds for child care are relatively low and parents rely on nonparental care (Vecchiotti, 2001). These policy issues of access to important educational inputs for less advantaged children as well as nonparental care that supports parents' work outside the home are present in discussions of access to kindergarten (of any form) and access to full-day kindergarten (Vecchiotti, 2001).

Belief Context of Debates About School Entry Age

Not only is age of entry a focus of policies that pertain to children's access to developmental and educational resources, but it also figures prominently in teachers' and parents' beliefs about children and their development that can have important consequences for their decisions pertaining to a specific child or group of children. For example, when teachers are asked to consider factors that they use in making decisions about children's readiness for school (in discussions they have with parents, for example), they identify the child's age as one of the factors they consider (Heaviside & Farris, 1993; NCES, 1993b). When analyzing teachers' decisions to retain a child in grade, researchers have found that the issue of whether the child was young for the grade is one of the most frequently identified reasons, both as a justification or explanation for the child's poor functioning and as a factor to consider when evaluating whether the child will fit into the cohort of children the subsequent year (Shepard & Smith, 1986). In this way, the child's age at entry to school is an organizer of teacher beliefs and attributions that, in turn, can have consequences for the child's experiences in school.

Similarly, age at entry to school is a focus of parents' concerns about school attendance and readiness. Parents routinely identify age as one of the most important dimensions of their readiness judgements (e.g., Brent et al., 1996; West et al., 1993). The rising rates of redshirting in the United States show that parents view age—and use age—as a mechanism to manipulate their children's school experiences and outcomes, indicating the extent to which beliefs about the importance of age as an indicator and predictor of developmental success dominate some parents' conceptualizations (e.g., Brent et al., 1996; Ma et al., 1995; NCES, 1997). It is also clear that parents and teachers focus their attention regarding school readiness on a number of early literacy skills, dispositions toward learning, and social competencies that extend across

the 3 to 7 age span (e.g., Heaviside & Farris, 1993; Rimm-Kaufman et al., 1999). Nevertheless, age figures prominently in the thinking of many parents and teachers, influencing their decision making, as it serves as a marker for them of child competencies. In this way, age stands as a proxy for related features of development such as physical and social maturity, as well as social and academic skills, which tend to correlate with age. To the extent that age itself is the primary predictor of outcome and thus its prominence in these decisions justified, its associations with child outcomes should be evaluated apart from these related skills and abilities. In short, age of entry can trigger a set of teacher beliefs, classroom practices, and placement decisions that reflect interactional and transactional mechanisms (Pianta, 2006).

Effects of Age of Entry to School

According to Stipek (2002), three different research strategies have been used to examine the effects of age of entry to school on children's success in school. The first strategy has been to compare outcomes for children who delayed entry by a year with those of children who entered school when they were eligible. This approach has generated results that are "inconclusive because accommodations are not made for the selection factors associated with the decision to hold a child out of school" (Stipek, 2002, p. 1). The second approach has been to compare children in the same grade who have different birthdays. Research using this approach has indicated that relatively older children have a modest academic advantage over younger ones in the first few grades of school, but that this advantage typically disappears. The third approach has been to compare children who are the same age but in different grades (but not necessarily in kindergarten when studied), as well as children who are a year apart in age but in the same grade. The results of studies following this third strategy have also indicated a modest but temporary advantage for older children. Moreover, there is no evidence that children who enter school at younger ages gain less from early school experience than children who begin at an older age. For example, one version of the third strategy, referred to as the *school cutoff design*, compares on a variety of literacy and numeracy skills growth in children who just make versus miss the cutoff for school entry (Crone & Whitehurst, 1999; Morrison, Griffith, & Alberts, 1997; Naito & Miura, 2001). Such work has shown that for academically important skills like alphabet recognition, word decoding, phonemic awareness, and simple addition, schooling effects are much greater than age effects (for a review, see Morrison, Bachman, & Connor, 2005). Overall, then, findings "provide more support for early educational experience to promote academic competencies than for waiting for children to be older when they enter school" (Stipek, 2002, p. 1).

Same Grade/Different Birthdays

The present study followed the second of the three approaches identified by Stipek (2002). Research that adopts this strategy of comparing children in the same grade who vary in age—due to different birthdays—is based on the assumption that birth dates are randomly distributed. Investigations of this kind generally detect differences in the beginning grades of school that favor older children. For example, Cameron and Wilson (1990) studied 315 second graders and discovered that those whose sixth birthday fell between September 1 and January 31 of their kindergarten year outperformed children with later birth dates. Some studies have also reported age-of-entry effects in the later elementary school grades. In the case of fourth graders in the Cameron and Wilson study, the oldest children (with September-January birth dates) outscored the youngest children (with May-September birth dates), but not those whose birth dates fell in between. Relatedly, Crosser's (1991) research on 90 seventh through ninth graders in Ohio school districts showed that fifth-grade tests of reading achievement were higher for the boys who were age 6 when they started kindergarten than those who were age 5 (although there were no differences in math achievement; see also Breznitz & Teltsch, 1989).

Not all studies that have examined variation in age among children in the same grade have detected differences on achievement tests, however, and this is true even when testing was done in kindergarten (Dietz & Wilson, 1985; Knard & Reinhertz, 1986). Moreover, investigations that have chronicled age differences in the early grades have often found them to be weaker at older ages (e.g., Jones & Mandeville, 1990; Sweetland & De Simone, 1987) or nonsignificant by the upper elementary grades (e.g., McClelland, Morrison, & Holmes, 2000; Stipek & Byler, 2001). Consider in this regard Jones and Mandeville's work on almost 200,000 South Carolina first, second, third, and sixth graders and Bickel, Zigmond, and Strayhorn's (1991) study of more than 200 Pittsburgh fifth graders: Whereas the former investigation indicated that the difference in performance that favored older relative to younger children on a basic skills assessment declined from first to sixth grade, the latter research showed that the significant difference between older and younger children on math achievement at entry to first grade was not evident amongst fifth graders.

To repeat, evidence from studies that adopted the design employed in the current report, when considered in its entirety, "suggests some small advantage of being relatively older than classmates which diminishes with age" (Stipek, 2002, p. 8). Results of this body of work have suggested, according to Stipek (p. 8), that "younger children actually [tend] to learn more," given that they generally catch up with their older peers over time after sometimes starting school at a relative disadvantage. Perhaps even more noteworthy is the fact that the effect size of age of entry to school tends to be rather modest. In fact, one study that compared the power of this variable to predict children's functioning to race and socioeconomic status found the proportion of risk attributed to the latter factors was 13 times greater than that attributed to entry age (Jones & Mandeville, 1990). Not to be forgotten in judging the meaning of such a result, however, is the fact that age of entry to school is invariably far easier for policymakers to change than are these other determinants of school achievement. Also susceptible to change, of course, with the potential for developmentally beneficial effects on children's achievement, is the quality of early child care and the preschool experience (NICHD [National Institute of Child Health and Human Development] Early Child Care Research Network, 2005).

As Stipek (2002) herself noted, the body of evidence under consideration does not permit unambiguous conclusions to be drawn about age-of-entry effects and especially their apparent dissipation over time. This is because most of this work has been done cross-sectionally, studying different children in, for example, first and fourth grade at the same time, rather than the same children over time. Moreover, the possibility that age-of-entry differences diminish across grades, because younger children are retained to a greater degree in later grades, has not been directly addressed. One contribution that the current inquiry makes is the longitudinal investigation of children's achievement trajectories from just before kindergarten entry to third grade. It is designed to do this after taking into consideration (i.e., controlling for) attributes of children (i.e., gender), of child care (i.e., quantity, quality, type), and of the family (i.e., income, maternal education, marital/partner status, maternal depression, parenting) measured prior to school entry that have been shown in previous reports on the NICHD Study of Early Child Care to be systematically related to children's socioemotional and cognitive-linguistic development (NICHD Early Child Care Research Network, 1999b; 2002). Thus, not only does this investigation seek to illuminate relations between age of entry to school and development over time, but it does so after controlling for a host of confounding factors measured prior to school entry that are known to predict child development.

The current study also affords the opportunity to examine longitudinally the effect of age of entry on children's social development, including behavior problems, social competence, and parent-teacher relations. Only a few investigations have examined these developmental outcomes as a function of variation in age within a given school grade. In one Israeli study, Breznitz and Teltsch (1989) failed to detect age effects on self-esteem and peer-relations scores

of fourth graders. Relatedly, Stipek and Byler (2001) failed to find any age effects using a variety of social-emotional measures on children in their first 4 years of school (i.e., through third grade). Before it is presumed that there is no relation between entry age and socioemotional functioning, however, attention should be called to a study of more than 500 kindergarten children that revealed a significant positive, though modest, association between age (treated as a continuous variable) and teacher and peer ratings of social skills and popularity, indicating greater social competence of older children (Spitzer, Cupp, & Parke, 1995).

In summary, in this study we examined differences in children's academic and social functioning during the kindergarten year in light of differences in age at kindergarten entry. We also examined whether age of entry made a difference in the rate of change in children's academic achievement and social skills as a function of initial age of entry. This latter feature enabled us to determine whether any early differences in functioning at the start of school that were a function of age attenuated—or grew larger—over time. Finally, we asked whether there were differences in functioning at the end of third grade related to age at kindergarten. In all cases, we controlled for child functioning prior to school entry, child gender, and measures of family and child care experiences through the first 4.5 years of life before we assessed the impact of entry age on child development. Such controls were implemented because work on this sample has clearly indicated that these factors and processes as assessed prior to children's entry to school are predictive of the very outcomes that this inquiry is attempting to relate to age of entry to school, and in just the manner that one might expect (e.g., greater maternal sensitivity and greater child care quality predict better social and academic functioning in the early elementary school years; NICHD Early Child Care Research Network, 2005). The inclusion of controls addressed Graue and DiPerna's (2000) recent call for research on the timing of children's initiation of schooling to begin at the start their school career so that, among other things, children's abilities, skills, and dispositions prior to going to school could be taken into account, thereby reducing the risk that effects of individual differences in children at the start of school would be misattributed to age of entry to school. This, of course, is a statistical and thus interpretive risk that undermines the confidence that can be placed in conclusions drawn from cross-sectional and/or retrospective studies that initiate data collection some time after school entry.

METHOD

Overview of the Study Design

Children at 10 different geographic sites were followed from birth to third grade. Mothers were interviewed in person when infants were 1 month old. When children were 6, 15, 24, 36, and 54 months old, we assessed the home and family environment, and for those in nonmaternal child care, we observed the child care setting. Mothers were telephoned every 3 or 4 months in the intervening time periods to update reports on child care use. Children's cognitive skills and social behavior were assessed at 15, 24, 36, and 54 months and in first and third grade. Social functioning was also assessed in kindergarten.

Participants

Families were recruited through hospital visits to mothers shortly after the birth of a child in January through early November 1991 in 10 locations in the United States. During selected 24-hr intervals, all women giving birth were screened for eligibility and willingness to be contacted again. Of the 8,986 mothers who gave birth during the sampling period, 5,416 (60%) agreed to be telephoned in 2 weeks and met the eligibility requirements (mother older than 18, spoke English, healthy; baby not multiple birth or released for adoption, lived within an hour of research site; neighborhood not too unsafe for teams of researchers to visit). Of that group,

a conditionally random sample of 3,015 was selected (56%) for the 2-week-out phone call; the conditioning ensured adequate representation (at least 10%) of mothers without partners, mothers without a high school degree, and ethnic minority mothers. At these calls, families were excluded if the infant had been in the hospital more than 7 days, the family expected to move in the next 3 years, or the family could not be reached with at least three attempts at contact. A total of 1,526 who were selected for the call were eligible and agreed to an interview; of these, 1,364 completed a home interview when the infant was 1 month old and became the study participants. These 1,364 families were very similar to the eligible hospital sample on years of maternal education, percentages in various ethnic groups, and presence of a partner in the home. The resulting sample was diverse, including 24% ethnic minority children, 11% mothers who had not completed high school, and 14% single-parent mothers.

Children recruited into the NICHD study were scheduled to enter kindergarten in 1996 (about 85% of the sample) or 1997, depending upon the age-of-entry policy of the state in which they were living. Children were included in the analysis sample if they had complete data on the predictors and had at least one outcome data point at any assessment period. Thus, the available sample for study was 913, although the number of children included in any one analysis varied due to missing data. In view of the scheduling of our kindergarten data collections (in 1996-1997 and 1997-1998), only a very small minority of children—that is, those who started kindergarten in the second wave of kindergarten data collection (1997-1998) —could have been redshirted by parents, as they could have started a year earlier (on the basis of their state's age-of-entry policy) but did not. This feature of the study is important to keep in mind, as it probably makes it different from many other studies that have recruited children through classrooms (rather than at birth).

Mothers in the available sample had an average of 14.57 years (SD = 2.42) of education (at the beginning of the study), and 13.9% were without a partner at third grade; average family income at third grade was 3.80 (SD = 2.80) times the poverty threshold; and 79.2% of the children were Euro-American, non-Hispanic. The participants differed from the 451 children who had been recruited but were not included in this analysis sample. Compared to mothers of nonparticipant recruits, mothers of participants had significantly ($p < .001$) more education (M = 14.57 years vs. 13.56 years) and were more likely ($p < .001$) to have a husband or partner in the household a greater proportion of the time between birth and 54 months (M = 0.86 vs. 0.78). Compared to nonparticipant recruits, participant children were less likely to be African American (10.5% vs. 17.1%), and participant families had significantly ($p < .001$) higher family incomes as determined by their average income-to-needs ratio between birth and 54 months (M = 3.80 vs. 3.12). (The income-to-needs ratio is an annually adjusted, per capita index that compares household income to federal estimates of minimally required expenditures for food and shelter. An income-to-needs ratio of 1.0 is the U.S. government definition of poverty, so a ratio of 3.0 represents a per capita income 3 times the poverty level.) The most common reason that a child (and family) was lost to longitudinal follow-up was because mothers declined the invitation to participate in additional data collections.

Despite the selective loss of more minority and at-risk families over time (i.e., greater minority, less education), the sample was by no means a simple White, middle-class one. With respect to the retained families, 26.1% of mothers had no more than a high school education (at time of enrollment), 24.8% had incomes no greater than 200% of the poverty level at third grade, and 20.8% were minority (i.e., not non-Hispanic Euro-American).

Procedures and Measures

In addition to the age—in months—when the child entered kindergarten, a number of variables were included in this study. In this section, measurements are described in terms of the role they played in the analyses to be reported. Variables used to control for family background

factors measured prior to the start of school (i.e., covariates) are described first, followed by measures reflecting the child's experiences in nonmaternal care prior to school entry. Thereafter, child outcome measures are described. Descriptive statistics (i.e., means, standard deviations) on all predictors and outcomes are presented in Table 1.

Maternal, Child, and Family Characteristics—The following maternal, child, and family characteristics were included in the analyses as controls for selection effects: maternal education in years (at time of enrollment into the study); family's average income-to-needs ratio (family income divided by the poverty threshold for its household size), based on income and family size data provided by mothers at 6, 15, 24, 36, and 54 months; proportion of these same five measurement occasions that mothers reported living with a husband or partner; child gender; and average maternal depressive symptoms as measured by the Center for Epidemiologic Studies-Depression Scale (Radloff, 1977) administered at 6, 15, 24, 36, and 54 months.

In addition, a composite measure of maternal sensitivity, based upon evaluations of observed maternal behavior at 6, 15, 24, 36, and 54 months (NICHD Early Child Care Research Network, 1999a, 2003a), served as a control variable in the analyses. Mother-child interaction was videotaped in semistructured 15-min observations at each age. The observation task at 6 months had two components. In the first 7 min, mothers were asked to play using any toy or object available in the home or none at all; for the remaining 8 min mothers were given a standard set of toys they could use in play with their infants. At 15, 24, 36, and 54 months, the observation procedures followed a three-boxes task in which mothers were asked to show their children age-appropriate toys in three containers in a set order (see Vandell, 1979). The mother was instructed to have her child play with the toys in each of the three containers and to do so in the order specified.

At each age a maternal sensitivity composite was constructed based on three ratings. At 6, 15, and 24 months it comprised the sum of three 4-point ratings: sensitivity to nondistress, positive regard, and intrusiveness (reversed). At 36 and 54 months, three 7-point ratings were composited: supportive presence, respect for autonomy, and hostility (reversed). For the purposes of this report, an across-time average maternal sensitivity score was calculated.

Tapes from all research sites were shipped to a single site for coding. Coders were blind as to other information about the families. Intercoder reliability was determined by assigning two coders to 20% of the tapes randomly drawn at each assessment period. Intercoder reliability for the maternal sensitivity composites was calculated as the intraclass correlation (Winer, 1971), which ranged from .83 to .87 over time.

Child Care Characteristics—Consistent with all other reports from the NICHD Study of Early Child Care and many other studies of child care, nonmaternal child care was defined as regular care by anyone other than the mother—including care by fathers, relatives, and nannies (whether in home or out of the home), family day care providers, and centers—that was routinely scheduled for at least 10 hr per week. Several features of individual children's care experiences measured from birth through 54 months figured importantly in this report to control for the effects of child care experiences prior to school entry.

Quantity Average hours per week in child care from 3 to 54 months represented the amount of nonmaternal care that th child experienced prior to school entry. Information on hours spent in care per week was obtained from telephone interviews with mothers at 3- or 4-month intervals about the number of hours and the types of care used during the prior 3 to 4 months.

Quality Quality was defined by the caregiver-child interaction and stimulation experienced by the target child in the child care setting. Observational assessments were obtained at 6, 15, 24, and 36 months for children who were in 10 hr or more per week of nonmaternal care. At 54 months, the criterion for observation was being in care for 7.5 hr or more per week (because many children were enrolled in preschool programs 3 days per week for 2.5 hr per day). Quality was assessed during two half-day visits scheduled within a 2-week interval at 6 to 36 months and one half-day visit at 54 months.

At each visit, observers completed two 44-min cycles of the Observational Record of the Caregiving Environment, during which they first coded the frequency of specific caregiver behaviors and then rated the quality of the caregiving. Positive caregiving composites were calculated for each age level observed by averaging these ratings. At 6, 15, and 24 months, the positive caregiving composite was based upon the mean of five 4-point ratings: sensitivity to child's nondistress signals, stimulation of child's development, positive regard toward child, detachment (reversed), and flatness of affect (reversed). Cronbach's alphas for the composite were .89 at 6 months, .88 at 15 months, and .87 at 24 months. At 36 months, these same five ratings plus two additional ones, fosters child's exploration and intrusive (reversed), were included in the composite (α = .83). At 54 months, the positive caregiving composite was the mean of 4-point ratings of caregivers' sensitivity/responsiveness, stimulation of cognitive development, intrusiveness (reversed), and detachment (reversed; α = .72). For this report, average quality of child care experienced across the first 54 months of life served as the index of child care quality.

To ensure that observers at the 10 sites would make comparable ratings, all observers underwent certification before beginning data collection. The certification test at each age consisted of six 44-min videotapes that had been master-coded by experts. Exact agreement with the master codes at a level of 60% or better was required. To prevent observer drift, all observers took two additional coding tests during the 10 months of data collection at each age assessment; a criterion of 60% exact agreement was used to allow continued data collection. In addition, observer agreement was assessed during live on-site observations. At each site, all possible pairs of observers were required to visit both home-based and center-based child care.

Reliability estimates for the positive caregiving composite score were computed for both the master-coded videotapes and live observations using Pearson correlations and the repeated measures analysis of variance formulation described in Winer (1971, p. 287). Reliability exceeded .90 at 6 months, .86 at 15 months, .81 at 24 months, .80 at 36 months, and .90 at 54 months.

Percent measurement epochs in center care For each of 16 epochs (3-month intervals from birth to 36 months and 4-month intervals after 36 months), the child's primary care arrangement was classified as center care, child care home care (any home-based care outside the child's own home except grandparent care), in-home care (by any caregiver in the child's own home except the father or a grandparent), grandparent care, or father care. Information was available on each setting with respect to the number of children present other than the target child. Epochs in which children were in less than 10 hr/week of nonmaternal care were coded as exclusive maternal care. For the purposes of this report, child care experience in terms of type of care was represented by the proportion of measurement epochs in which the child received care in a center.

Child Outcomes—Four subscales of the repeatedly administered Woodcock-Johnson Psycho-educational Battery (Woodcock & Johnson, 1989) (i.e., letter-word recognition, applied problems, memory for sentences, picture vocabulary) and two teacher ratings (of language and math skill) served as the cognitive achievement outcomes of this report. Five

measures of social functioning (i.e., externalizing problems, internalizing problems, social competence, teacher-child closeness, and teacher-child conflict) based on caregiver and teacher reports served as the other set of outcomes.

With respect to cognitive-academic achievement, children were administered at 54 months and in the spring of first and third grade four subtests from the Woodcock-Johnson Psycho-Educational Battery-Revised (Woodcock & Johnson, 1989): Letter-Word Recognition, which assesses prereading skills in identifying isolated letters and words; Applied Problems, which measures skill in analyzing and solving practical problems in mathematics; Memory for Sentences, which measures exactly what its name implies; and Picture Vocabulary, which measures children's ability to name objects depicted in a series of pictures. Items are presented in order of increasing difficulty and are scored 0 = *incorrect* or *no response* or 1 = *correct response*, with basal and ceiling levels established. Typically, raw scores are converted to standard scores with a mean of 100 and a standard deviation of 15, (McGrew, Werder, & Woodcock, 1991), but for this study we relied upon W ability scores so that change over time could be more easily documented. The W ability scores are transformations of the Rasch raw ability scores designed to eliminate the need for decimal fractions and negative values. W scores have several desirable features that make them particularly useful when examining change in performance over time; most importantly, "statistical values, such as standard deviations and standard errors of measurement, have the same mathematical meaning at any level and in any area of measurement" (McGrew et al., 1991, p. 52). Thus, for example, a 10-point increase between kindergarten and first grade indicates the same increase in level of success on a subtest as does a 10-point increase between second and third grade.

In addition to administering standardized tests, teachers in kindergarten, first, second, and third grade rated children's language and math skills using the Academic Skills Questionnaire (Nicholson, Atkins, Burnett, & Meisels, 2002). The Language and Literacy Scale deals with skills related to listening, speaking, and early reading and writing. The Mathematical Thinking Scale deals with the child's ability to perceive, understand, and utilize skills in solving mathematical problems. Depending on the year of administration, the Language and Literacy Scale and the Mathematical Thinking Scale had from 10 to 15 items each. Children's performance was rated on a 5-point scale, ranging from 1 = *not yet* to 5 = *proficient*; the scale was designed to reflect the degree to which a child had acquired and/or chose to demonstrate the targeted skills, knowledge, and behaviors. At each time point, scale scores were computed by averaging across items making up each scale. Internal consistency was excellent at all time points, ranging from .93 to .95 for Language and Literacy and from .91 to .94 for Mathematical Thinking.

To assess social competence, caregivers (at 54 months) and teachers (in kindergarten, first grade, third grade) completed the Social Skills Questionnaire from the Social Skills Rating System: Grades K-6 (Gresham & Elliott, 1990). This instrument is composed of 38 items describing child behavior, each rated on a 3-point scale reflecting how often the child exhibits each behavior. Items are grouped into four areas: cooperation (e.g., keeps room neat and clean without being reminded), assertion (e.g., makes friends easily), responsibility (e.g., asks permission before using someone else's property), and self-control (controls temper when arguing with other children). The total score used in this report represents the sum of all 38 items, with higher scores reflecting higher levels of perceived social competence (α = .86-.94). The Social Skills Rating System: Grades K-6 was normed on a diverse, national sample of children and shows high levels of internal consistency (median = .90) and test-retest reliability (.75-.88) and moderate concurrent and predictive validity to other indices of social competence.

To measure behavior problems, caregivers (at 54 months) and teachers (in kindergarten, first grade, second grade) completed the age-appropriate Teacher Report Form (TRF) of the Child

Behavior Checklist (Achenbach, 1991a,b), a widely used measure of behavior problems. At 54 months, the C-TRF 2-5y was used by caregivers, and in kindergarten through third grade teachers completed the 100-item TRF 5-18y version. Reliability and validity of these instruments are well established (Achenbach, 1991a). Two major subscale scores derived from this instrument served as dependent variables (at each age of measurement). One tapped externalizing problems (e.g., aggression, disobedience) and the other internalizing problems (e.g., withdrawal, somatic complaints, anxiety, depression). Normalized *T* scores for internalizing and externalizing were provided by the Cross-Informant Program for the Child Behavior Checklist/4-18 and TRF. Achenbach (1991a) reported Cronbach's coefficient alphas of .95 and .96 for the Internalizing and Externalizing subscales, respectively, on the TRF.

To assess teacher-child conflict and teacher-child closeness at 54 months (caregiver reports) and in kindergarten, first grade, and third grade (teacher reports), respondents completed the Student-Teacher Relationship Scale (Pianta, 2001). This is a widely used indicator of a teacher's perceptions of the quality of his or her relationship with a specific child. Coefficient alphas for the Conflict and Closeness subscales ranged from .86 to .90.

Analysis Plan

Hierarchical linear modeling (Bryk & Raudenbush, 1992) was used to estimate individual growth curves including random intercepts, random linear slopes, and fixed quadratic slopes to describe change over time in adjustment/achievement. Intraclass correlations that examined the extent to which the various outcomes exhibited variation due to site indicated that this was minimal. Intraclass correlations for site ranged from 0.00 to 0.02 for the cognitive-academic outcomes and from 0.00 to 0.03 for the social-emotional outcomes. All models were fit using SAS Proc MIXED (Singer, 1998). The initial baseline model was specified as follows:

$$\text{Level 1: } Y_{it} = \pi_{0i} + \pi_{1i}\,\text{time}_{it} + \pi_{2i}\,\text{time}_{it}^{2} + \varepsilon_{it}$$

$$\text{Level 2: } \pi_{0i} = \gamma_{00} + \zeta_{0i}$$

$$\pi_{1i} = \gamma_{10} + \zeta_{1i}$$

$$\pi_{2i} = \gamma_{20}$$

For all outcomes, *time* was coded as -1 at the 54-month assessment, 0 at the kindergarten assessment, 1 at the first-grade assessment, 2 at the second-grade assessment, and 3 at the third-grade assessment. This coding ensured that (a) the intercept (π_{0i}) reflected the anticipated score for individual children for the outcome under consideration at kindergarten, (b) the linear slope (π_{1i}) reflected the anticipated individual linear change per year between 54 months and third grade, and (c) the quadratic slope (π_{2i}) reflected the average (fixed) acceleration or curvature in growth between 54 months and third grade. Because only the intercept and linear terms were specified as random, this model was appropriate regardless of whether the outcome was measured three (Woodcock-Johnson), four (Academic Skills, Social Competence) or five (Child Behavior Checklist, Closeness/Conflict With Teacher) times (i.e., the number of observations exceeded the number of random parameters specified at Level 1; Bryk & Raudenbush, 1992; Singer, 1998). Tests were conducted for each outcome to determine the most appropriate fixed-effects portion of the model (i.e., linear, quadratic, cubic), using the Akaike Information Criteria for finite samples (Burnham & Anderson, 1998; Hurvich & Tsai, 1989) and the Baysian Information Criteria (Schwartz, 1978) to judge whether one model was better suited than another. These tests indicated that Mathematical Thinking, Externalizing, and Conflict With Teacher were adequately described with a linear model; Woodcock-Johnson items needed a quadratic model; and Language and Literacy, Internalizing, Social Competence, and Closeness With Teacher required a cubic model.

With one exception (linear slope for Mathematical Thinking), the models for all outcomes showed significant variation in intercept and linear slope. Additionally, the fixed effects for all included linear, quadratic, and cubic slopes were significant, giving us confidence to proceed with the predictive model.

After the baseline models were finalized, independent variables were added to predict the intercept and linear slope in the Level 2 model. Each set of predictors included (a) a series of covariates reflecting mother, child, and family demographic/background factors (i.e., site, child gender, mother's education [in years when child was 1 month of age], proportion of measurement occasions [1-54 months] that mother lived with a husband/partner, average maternal depression [1-54 months], average income-to-needs ratio [1-54 months], and average maternal sensitivity [based upon repeated measurements, 6-54 months]); (b) three child care parameters reflecting the average hours per week that children spent in nonmaternal care from 3 to 54 months, the average quality of child care they experienced between 6 and 54 months, and the proportion of measurement occasions between 3 and 54 months in which children were in center-based care; and (c) age of entry to kindergarten. Additional predictors for the quadratic term were also examined. Because no significant findings were observed for the variables of interest, these terms were removed from the final model.

The prediction model was run for all outcomes three times, using three different approaches to operationalizing age of entry to kindergarten: treating age as a continuous variable; coding the child as having turned 5 (or not) by July 1 of the year he or she started kindergarten; and coding the child as having turned 5 (or not) by September 1 of the year he or she started kindergarten. The latter two approaches were deemed appropriate given policy debates about appropriate age cutoffs for entry to kindergarten. In this report we present only the results of analyses in which age of entry was treated as a continuous variable because it was this parameterization of child age that yielded the most consistent and largest effects across all outcomes. It is important to note that in large-scale studies like this one, birth date cutoffs for entry into school vary across states and districts; Stipek (2002) concluded that such variation is unlikely to bias findings in any systematic way. In the interest of space, the reporting and discussion of results are restricted almost exclusively to age-of-entry effects, as all other variables in the prediction model functioned as control variables reflecting children's experiences prior to school entry.

RESULTS

Results of the hierarchical linear modeling analyses in which age was entered as a continuous variable are presented in Tables 2 and 3 for cognitive-academic and social-emotional outcomes, respectively. Because tests of interactions between age of entry and, separately, child care hours, child care quality, center-care experience, child gender, income-to-needs ratio, and maternal sensitivity yielded few significant effects, and those that did emerge, when examined more closely, evinced no consistent—or often interpretable—pattern, these are not further discussed. Effect sizes for age of entry, reflecting the partial correlation between age of entry and the intercept and slope (McCartney & Rosenthal, 2000), are presented in bold for easy identification.

Cognitive-Academic Functioning

Of the six cognitive-academic outcomes, age of entry proved to be significantly related to three measures of children's estimated functioning in the fall of their kindergarten year (i.e., intercept) and to four measures of change over time in children's functioning (i.e., slope). Considering first the prediction of children's estimated cognitive-academic functioning in the fall of their kindergarten year, results revealed that children who began school at a younger age scored higher on the Letter-Word Recognition subtest but received lower ratings from

teachers on the Language and Literacy and Mathematical Thinking Scales than did children who began school at an older age. Although significant, effect sizes for these findings were generally small (Cohen, 1988), ranging from .09 to .14. With respect to rate of change over time, children who began school at an older age evinced greater increases over time (i.e., slope) than children who began school at a younger age on the Woodcock-Johnson Letter-Word Recognition, Applied Problems, Memory for Sentences, and Picture Vocabulary subtests. Again, effect sizes for these significant results were small, ranging from .10 to .17.

In light of evidence that rate of growth (i.e., slope) varied as a function of age of entry in the case of these outcomes, we reanalyzed the data for these four outcomes to determine whether the differential rates of growth as a function of age of entry already reported produced significant differences in level of functioning in third grade as a function of age of entry. After all, just because children who began school at older and younger ages developed at different rates does not mean that the rate-of-change differential is sufficient to produce differences in levels of functioning by the time children were in third grade. To address this issue, the same prediction model already described was rerun, but the intercept (i.e., predicted outcome) was set at third grade (rather than kindergarten age as had been the case in the original prediction models). When this was done, in two of four instances an originally detected effect of age of entry on rate of growth (i.e., slope) produced a significant age-of-entry effect when functioning in third grade was examined: The older the child was at entry to kindergarten, the better his or her performance on the Applied Problems ($b = 5.16$, $p < .01$) and Picture Vocabulary ($b = 4.40$, $p < .001$) subtests when in third grade.

We also sought to determine whether previously detected age-of-entry effects on children's functioning in kindergarten—in the absence of significant effects of age of entry on growth rates (i.e., slope)—resulted in sustained age-of-entry effects through third grade. Thus, the original prediction model was rerun, once again setting the intercept to third grade, in the case of the Letter-Word Recognition subtest (on which children starting school at younger ages scored higher than those starting at older ages) and the two academic skill ratings provided by teachers (on which older children scored higher in kindergarten). Results of these three reanalyses yielded evidence that, by third grade, children who began school at older ages scored no differently on the Letter-Word Recognition subtest than those who had begun at younger ages, but these children continued to outperform children who had started at younger ages on the teacher-rated Language and Literacy ($b = .18$, $p < .10$) and Mathematical Thinking ($b = .21$, $p < .05$) Scales.

Social-Emotional Functioning

The age at which children began school proved unrelated to their social-emotional functioning. This was true when the relevant outcome measures reflected children's level of functioning in the fall of the kindergarten year and linear changes over time from 54 months to third grade.

DISCUSSION

The results of this inquiry revealed, in the main, that in several respects having to do only with cognitive-academic functioning (and not at all with social-emotional functioning), children who began school at a somewhat older age performed better at the start of school, evinced greater improvement over the course of their first years of schooling, and functioned at a more advanced level in third grade than children who began school at a somewhat younger age. Though clearly statistically significant, these effects of age of entry did not apply to all cognitive-academic outcomes, were modest in absolute size, and were limited relative to the predictive power of other factors treated as covariates in the analyses. As such, and especially in light of strong beliefs popularly held by many about the power of age of entry and considered in detail in the introduction to this article, it appears that although real, the effects of age of

entry on children's academic achievement and certainly on their social functioning are not of major importance when it comes to variation in children's performance at the start of school or during the first years of schooling. By itself, then, it does not appear that the child's age at the beginning of his or her first year in school should figure importantly in decisions about whether a child should actually start school when first qualified—by age—to do so. This is not to say, however, that age relative to peers should not be something that merits some modest consideration in the context of perhaps more important factors (e.g., actual behavior and ability) when school-entry decisions are made.

It is important to frame the interpretation of the results of this investigation in light of key aspects of the design of this prospective, longitudinal study. Our analyses of age-of-entry effects differ from most previous investigations of this issue in that the outcome data are based on repeated measurements of children's tested and teacher-reported functioning across the first several years of school rather than upon cross-sectional comparisons of different sets of children in different grades. We were thus able to predict, using age of entry to school, not only children's actual or estimated functioning at the start of kindergarten (i.e., intercept) or even in third grade (as part of select follow-up analyses), but change over time in their functioning as well (i.e., slope), after taking into account antecedent family background factors and child care experiences known to be significant predictors of the very school outcomes under investigation (e.g., Meisels, 1999). Because of these design features, especially the controlling of children's levels of functioning prior to entry to school (cf. Graue & DiPerna, 2000), analyses presented in this report provide some of the most well-controlled and comprehensive examinations of age-related effects to date.

The nature of our study makes it distinctive relative to many related investigations in other ways. In particular, the current study design involved (a) following through the first years of schooling children and families recruited when the children were born, and (b) given the variation in where children lived, typically studying only one child in a classroom. In addition, children included in this investigation were all enrolled in kindergarten for the first time in one of only two study years. This means that only a small number of students who would have been eligible for kindergarten in the first of these two years had their entry to kindergarten delayed until the second year. This design feature should be kept in mind, as it makes this investigation of age of entry to school somewhat different from that of many other studies that recruit entire classrooms of kindergarten or older children and thus include perhaps a greater proportion of children whose entry to school had been intentionally delayed among the children who were older than their classmates.

The results of this inquiry indicate that age of entry to school, when operationalized in continuous form (but not categorical form based on established cutoff dates), shows some significant, if limited, relation to children's cognitive-academic achievement (but not social functioning) at the start of school and through third grade when such associations are adjusted for prior experience at home and in child care. The most consistent effect of age of entry detected in this inquiry was for children who began school at older ages to evince greater growth in all four areas of academic achievement tested using the Woodcock-Johnson assessment (i.e., Letter-Word Recognition, Applied Problems, Memory for Sentences, and Picture Vocabulary subtests). This differential rate of growth was sufficient to result in significant, if only modest, differences by third grade between the performance of children who entered school at older and younger ages—favoring the former children—on two of the four subtests (i.e., Applied Problems and Picture Vocabulary), even though no such age-of-entry effects had been evident at the start of school (i.e., early in the kindergarten year). Not inconsistent with these results were related findings showing that by third grade, teachers also rated children who began school at older ages significantly better on the Mathematical Thinking Scale and marginally better on the Language and Literacy Scale than children who began school at younger ages.

These findings are especially interesting because, in some respects (and only some respects), they are rather inconsistent with recent conclusions drawn by Stipek (2002, p. 8) on the basis of evidence to date pertaining to age-of-entry effects. Recall that she observed that "younger children actually [tend] to learn more," given some data from some cross-sectional studies showing that younger children generally catch up with their older peers over time if they start school with a developmental disadvantage (see also Smith & Shepard, 1987). Data from the current inquiry showing that children who started school at older ages evinced greater growth in performance on all four of the Woodcock-Johnson subtests and scored higher on two of them by third grade than children who started school at younger ages clearly suggest that older children are, to some extent, getting more out of school academically than younger children. This would seem especially so in light of the fact that we detected no evidence that children who entered school at younger ages performed more poorly on achievement tests early in kindergarten than did those who entered school at older ages. What remains unclear, of course, is whether this pattern of results emerging from this longitudinal study will remain as children age. Evidence from cross-sectional studies calls this possibility into question, as such investigations routinely indicate that even when age-of-entry differences are found in the early years of schooling, including at second and fourth grade (e.g., Cameron & Wilson, 1990), they are not evident at older ages (e.g., Jones & Mandeville, 1990; McClelland et al., 2000; Stipek & Byler, 2001; Sweetland & De Simone, 1987).

This latter point should also draw attention to the fact that in certain respects, the results of this inquiry are consistent with Stipek's (2002) analysis of past research of the effects of age of entry. First, differences favoring children entering school at older ages on teacher ratings of language and math skill in kindergarten were not evident 4 years later, clearly suggesting that children who entered school at younger ages had indeed caught up with their older counterparts, at least with respect to teacher perceptions of academic skill. Second, even on some of those cognitive achievement outcomes that showed greater rates of growth for children who entered school at older ages, these rates were not sufficient to translate into significant age-of-entry differences in third grade. Clearly, it would be a mistake, then, to draw too strong conclusions from this inquiry about age affecting even children's academic achievement or about older children differentially benefiting from schooling.

Indeed, when considered within a broader developmental framework, age of entry to school appears to play only a modest role with respect children's early school performance. After all, careful inspection of Tables 2 and 3 clearly shows that several other aspects of children's experiences that were measured, sometimes repeatedly, in the course of the NICHD Study of Early Child Care and treated, conceptually, as covariates in this inquiry were typically stronger and/or more consistent predictors of both the cognitive-academic and social-emotional outcomes under investigation than age of entry to school. Indeed, on the basis of the predictive power of these covariates, a subject not discussed in the reporting of results in the interest of saving space, it is clear that experiences with sensitive, stimulating parenting, in homes in which economic and educational resources are present, and in which primary caregivers (mothers) are emotionally healthy, appear to be far more important determinants of schooling outcomes.

The policy context of debates of the effects of age of entry to school is largely dependent on the extent to which entry cutoff dates should be moved in one direction or another to accommodate children's (and schools') needs. In our analysis of the two most commonly used cutoff dates (early July, early September), we found no association between children's status as older or younger relative to those dates and their functioning in school. Clearly, shifts in the cutoff dates used by various school systems do have repercussions in terms of the level of children's skills expected to be present at the start of school (see Stipek, 2002); but our analyses, and those of other investigators (see Vecchiotti, 2001), clearly point out that variation in age

within grade is by no means a major factor in determining a child's school performance. Thus, it may be appropriate to conclude that policies regarding age of entry to school probably have rather limited relevance, if any, for the performance of children over the course of their elementary school careers, especially when age ranges are as constrained as those in the present investigation. Although such policies will have implications for what is taught in school, and perhaps even how it is taught, apparently they will have only limited impact, if any, when it comes to altering individual differences in children's school performance. Age-of-entry policies thus are better suited for concerns about access or eligibility for educational programming and the resources (space, number of teachers) required for such programming.

These findings may also have implications for beliefs about the importance of age as a determinant of school performance. As was noted earlier, age figures prominently, even if not exclusively, in teachers' (e.g., NCES, 1993b; Rimm-Kaufman et al., 1999) and parents' views about what makes a child likely to succeed in school. Such beliefs can be—and have been—used to justify decisions to hold out (or accelerate) a child in school or to retain a child in grade (Shepard & Smith, 1986). Many of these beliefs are based on ill-defined assumptions about the association between age and social maturity or some other factor indicating benefits for social functioning in the classroom. These beliefs about age effects, particularly as they pertain to social functioning, received no support from the results of this inquiry, as age of entry to school proved unrelated to any aspect of social functioning measured in this study. Recall that after controlling for prior developmental experiences, teachers' ratings did not distinguish the social functioning of children who entered school at relatively older and younger ages—either when they began school or 4 years later (i.e., in third grade)—nor did age of entry relate to changes in children's social functioning across this developmental period. Once again, however, the design of the current study that afforded inclusion of only a modest proportion of redshirted children, perhaps in contrast to other studies, needs to be kept in mind when considering the results presented.

Readers should also be aware of the findings from Byrd, Weitzman, and Auinger's (1997) investigation of parental reports of behavior problems from a nationally representative sample of more than 9,000 children aged 7 to 17 who participated in the Child Health Supplement of the 1988 National Health Interview survey. In this work, not only was it the case that old-for-grade students (who had not been retained) were more likely to score very high (= 90th percentile) in behavior problems than other (nonretained) children (i.e., 12% vs. 7%), but this age-of-entry effect increased with age, becoming especially apparent during adolescence. Interestingly, recent work carried out in the United Kingdom (where children can begin school at age 4) on a nationally representative sample of more than 10,000 children aged 5 to 15 found virtually the opposite; that is, it was children who were relatively younger than classmates who were more likely than to have higher symptom scores on a psychopathology checklist and even to be diagnosed with a psychiatric disorder (this was true during adolescence even after taking into account a host of independent risk factors; Goodman, Gledhill, & Ford, 2003). These results from two large-scale studies should make clear that age-of-entry effects can be long lasting and may even take time to materialize. Indeed, the Byrd et al. findings from the United States should remind readers that the absence—or presence—of age-of-entry differences early in the school career does not necessarily foreshadow similar findings when children are older.

To the extent that age of entry was predictive of cognitive and achievement outcomes early in the school career (i.e., in kindergarten) in the present study, there was some limited evidence that children who started school at a younger age performed better at the start of school whereas those who started school at an older age performed increasingly better over time. Recall that the former children started school scoring higher on a test of early literacy skills (Letter-Word Recognition subtest) but not on any other tested measure, whereas, as already noted, the latter children showed greater increases in several academic areas. In all cases of significant age-of-

entry findings with achievement outcomes, however, the associations were rather modest. Moreover, the single significant effect of age of entry on cognitive-academic functioning at kindergarten showing that children who started school at younger ages performed better on letter-word recognition failed to emerge when a base regression model was used that did not include any covariates other than child gender. Such a result raises the possibility that this one somewhat surprising age-of-entry effect might be random or a product of some not-as-yet understood process of statistical suppression. In sum, although age of entry to school does show some association with achievement functioning in school, and it may be the case that children who start school at a relatively older age than classmates are able to make better use of instructional resources provided in classrooms (and hence show increasingly better performance over time), the associations detected are modest and would not appear to justify the strength with which beliefs about age and maturity dominate many, if not all, discussions about readiness for school (Meisels, 1999). Moreover, it remains unclear what policy implications would derive from these results, as there will always be children within a class who vary in terms of their age of entry to school.

In addition to examining the main effects of age of entry on functioning in kindergarten and growth to third grade, we also sought to extend work on age of entry by assessing whether the effect of age of entry was moderated by a variety of other factors in a manner consistent (or inconsistent) with the oft-reported expectation that children who begin school at younger ages are disproportionately disadvantaged (relative to peers starting school at older ages) when they are poor, or are boys, or come from less stimulating or supportive homes. Few studies have examined such moderational propositions. Results of this inquiry revealed that the effects of age of entry did not vary systematically as a function of child, family, or child care factors.

Conclusion

In sum, over and above experiences at home and in child care, the age that children entered school showed some modest relation to school achievement, especially growth in achievement, with children who entered school at an older age progressing faster than children who started school at a somewhat younger age; but no relation with social functioning at the start of school or relative increases in functioning across the first 3 years of school. Age of entry as a source of policies about educational process or as a source of beliefs about readiness to benefit from school experience would seem, then, to have limited empirical support. In short, it is not unreasonable to conclude that debates about age may be of more theoretical than practical importance. Nevertheless, consideration of age of entry to school could be an additional factor that merits some limited weighting when integrated with other potentially influential factors and processes, most especially ones having to do with the child's social, emotional, and cognitive competencies.

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TABLE 1

Descriptive Statistics

Variable	*Early Childhood (1-54 Months)*			*54 Months*			*Kindergarten*			*1st Grade*			*2nd Grade*			*3rd Grade*	
	M	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*	*N*	*M*	*SD*
Outcomes																	
WJ Letter-Word			878	370.1	21.0				875	454.4	22.2				831	494.8	17.6
WJ Applied Problems			875	425.9	18.7				873	470.9	15.1				830	498.2	12.2
WJ Memory for Sentences			875	458.0	18.0				868	481.8	14.7				830	495.4	14.1
WJ Picture Vocabulary			881	460.2	14.1				869	484.3	12.1				831	497.3	10.9
Language and Literacy						841	3.1	1.0	863	3.4	0.9	787	3.3	0.9	811	3.6	0.9
Mathematical Thinking						839	3.0	0.9	862	3.2	0.9	784	3.4	0.9	805	3.4	0.9
Externalizing Problems			658	50.0	9.5	856	49.8	8.9	865	50.8	8.8	784	50.4	8.7	802	51.2	9.0
Internalizing Problems			658	50.6	9.7	856	46.8	9.0	865	49.2	9.4	784	48.8	9.9	802	51.4	9.5
Social Competence						847	103.7	13.9	860	103.4	13.7	775	105.4	14.3	796	102.7	14.2
Closeness With Teacher			661	4.1	0.6	858	4.3	0.7	864	4.3	0.6	794	4.2	0.6	798	4.1	0.6
Conflict With Teacher			660	1.6	0.5	858	1.5	0.8	864	1.6	0.7	793	1.6	0.8	799	1.6	0.8
Predictors (n = 913)																	
Gender (% male)	50.3%																
Maternal education	14.6	2.4															
% Partner in home[a]	0.9	0.3															
Maternal depression	9.5	6.2															
blIncome-to-needs ratio	3.8	2.8															
Maternal sensitivity	9.6	1.2															
Hours in child care	27.0	15.1															
Quality of child care	3.0	0.4															
% Center care[b]	0.2	0.3															
Age of entry to school	5.4	0.3															

Note. WJ = Woodcock-Johnson.

[a]Percentage of 5 measurement epochs of father figure in home.

[b]Percentage of 16 measurement epochs of child in center care.

TABLE 2

Growth Models Testing Effect of Age of Entry to School on Cognitive-Academic Outcomes (n = 906)

Effect	*WJ Letter-Word*	*WJ Applied Problems*	*WJ Memory for Sentences*	*WJ Picture Vocabulary*	*Language and Literacy*	*Mathematical Thinking*
Random effects						
Var (intercept)	195.30****	132.90****	141.09****	76.76****	0.37****	0.26****
Cov (intercept, linear slope)	-5.72	-16.69****	-13.74****	-7.67****	-0.02*	-0.01
Var (linear slope)	4.10**	2.43**	5.69****	2.34****	0.03****	0.01
Correlation between intercept and linear slope	-0.20	-0.93****	-0.48****	-0.57****	-0.23*	-0.16
Fixed effects						
Intercept	417.17****	448.67****	469.10****	473.03****	2.97****	2.96****
Site	—[a]	—[a]	—[a]	**	**	****
Male	-1.60	-0.42	0.40	3.26****	-0.24****	-0.06
Maternal education	1.54****	0.96****	0.83***	1.08****	0.06****	0.06****
% Partner in home[b]	0.88	1.42	-0.88	0.00	0.19	0.09
Maternal depression	-0.02	-0.05	-0.13	-0.01	0.00	0.00
Income-to-needs ratio	0.64*	0.43*	0.45*	0.45**	0.01	0.02
Maternal sensitivity	6.42****	7.55****	5.50****	4.87****	0.23****	0.26****
Hours in child care	0.07	0.05	0.01	0.04	0.00	0.00
Quality of child care	3.90**	3.39**	2.99**	3.29****	0.13	0.12
% Center care[c]	1.57	1.59	3.16	0.94	0.14	0.04
Age of entry to school	**-5.10****	**-1.65**	**-1.84**	**0.15**	**0.34*****	**0.39****
Linear slope	42.09****	21.90****	12.11****	12.26****	0.78**	0.11*
Site	****	**	****	**	—[a]	*
Male	0.71*	1.13****	0.33	-0.25	0.05*	0.05*
Maternal education	-0.06	-0.06	0.02	-0.01	0.00	-0.01
% Partner in home[b]	1.16	0.49	0.42	0.11	-0.02	-0.03
Maternal depression	0.00	0.00	0.05*	0.01	0.00	0.00
Income-to-needs ratio	-0.14	-0.07	0.01	-0.07	0.01	0.01
Maternal sensitivity	-0.42	-1.31****	-0.13	-0.27	0.02	-0.02
Hours in child care	0.00	0.00	0.00	0.00	0.00**	0.00
Quality of child care	-0.53	-0.52	-0.59	-0.55*	0.02	-0.02
% Center care[c]	-0.43	-0.46	-1.04	-0.25	-0.11*	-0.03
Age of entry to school	**2.29*****	**2.29****	**1.36****	**1.41****	**-0.05**	**-0.06**
Quadratic slope	-5.45****	-2.21****	-1.27****	-1.39****	-0.59****	
Cubic slope					0.13****	
Effect sizes						
Age of entry to school on intercept[d]	**0.09****	**0.04**	**0.04**	**0.00**	**0.12*****	**0.14****
Age of entry to school on linear slope[e]	**0.09*****	**0.13****	**0.07****	**0.10****	**0.03**	**0.03**

Note. Effect sizes for age of entry are in bold. WJ = Woodcock-Johnson.

[a] Nonsignificant.

[b] Percentage of 5 measurement epochs of father figure in home.

[c] Percentage of 16 measurement epochs of child in center care.

[d] Computed to reflect anticipated *SD* change in the outcome with a 1-year change in age of entry.

[e]Computed to reflect anticipated *SD* change in the outcome with a 1-year change in the interaction between age of entry and time.

*$p < .05$.

**$p < .01$.

***$p < .001$.

****$p < .0001$.

TABLE 3

Growth Models Testing Effect of Age of Entry to School on Social-Emotional Outcomes

Effect	*Externalizing (n = 903)*	*Internalizing (n = 903)*	*Social Competence (n = 900)*	*Closeness With Teacher (n = 908)*	*Conflict With Teacher (n = 908)*
Random effects					
Var (intercept)	32.12***	16.23****	67.68****	0.084****	0.135****
Cov (intercept, linear slope)	-1.68**	-0.62	-4.84	0.001	0.019****
Var (linear slope)	1.94***	1.37**	4.73**	0.003	0.006**
Correlation between intercept and linear slope	-0.21**	-0.13	-0.27	0.06	0.67****
Fixed effects					
Intercept	50.01***	47.90****	103.23****	4.24****	1.52****
Site	—[a]	—[a]	—[a]	*	—[a]
Male	-0.15	-0.09	0.98	-0.17****	0.13****
Maternal education	-0.24	-0.15	0.79***	0.01	-0.01
% Partner in home[b]	-3.63***	-0.81	5.33**	-0.01	-0.28****
Maternal depression	0.09*	0.06	-0.11	0.00	0.00
Income-to-needs ratio	0.01	-0.01	-0.25	0.00	0.00
Maternal sensitivity	-1.47***	-0.61	2.32**	0.02	-0.07*
Hours in child care	0.08***	0.01	-0.04	0.00	0.01****
Quality of child care	0.07	-0.29	1.94	0.05	-0.01
% Center care[c]	3.04**	0.77	-2.31	-0.04	0.22**
Age of entry to school	**1.13**	**-0.05**	**0.98**	**0.00**	**0.09**
Linear slope	0.02	-1.14**	-3.49*	0.07**	0.03
Site—[a]	—[a]	—[a]	—[a]	—[a]	
palphaMale	0.00	0.05	-0.35	-0.05***	0.06****
Maternal education	-0.01	0.00	-0.03	0.00	0.00
% Partner in home[b]	-0.31	-0.38	0.53	0.08**	-0.05
Maternal depression	0.00	-0.02	0.03	0.00	0.00
Income-to-needs ratio	0.01	-0.04	0.11	0.00	0.00
Maternal sensitivity	-0.33*	-0.53**	0.22	0.00	-0.03*
Hours in child care	-0.02*	-0.01	0.00	0.00	0.00
Quality of child care	-0.11	-0.05	-0.10	0.01	-0.01
% Center care[c]	-0.60	-0.15	0.66	0.06*	-0.06*
Age of entry to school	**-0.29**	**-0.48**	**0.76**	**-0.03**	**0.02**
Quadratic slope		1.55****	3.80**	-0.08****	
Cubic slope		-0.29***	-0.96***	0.01**	
Effect sizes					
Age of entry to school on intercept[d]	**0.05**	**0.00**	**0.02**	**0.00**	**0.05**
Age of entry to school on linear slope[e]	**0.02**	**0.02**	**0.02**	**0.02**	**0.01**

Note. Effect sizes for age of entry are in bold.

[a] Nonsignificant.

[b] Percentage of 5 measurement epochs of father figure in home.

[c] Percentage of 16 measurement epochs of child in center care.

[d] Computed to reflect anticipated *SD* change in the outcome with a 1-year change in age of entry.

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[e]Computed to reflect anticipated *SD* change in the outcome with a 1-year change in the interaction between age of entry and time.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

**** $p < .0001$.