Evaluation of the North Carolina More at Four Pre-kindergarten Program

Children's Longitudinal Outcomes and Classroom Quality in Kindergarten

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August 2006

UNC
FPG CHILD DEVELOPMENT INSTITUTE

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Overview of the More at Four Program

The North Carolina More at Four Pre-kindergarten Program is a state-funded initiative for at-risk 4-year-olds, designed to help them be more successful when they enter elementary school. More at Four is based on the premise that all children can learn if given the opportunity, but at-risk children have not been given the same level of opportunity. The purpose of More at Four is to provide a high quality, comprehensive educational program for at-risk children during the year prior to kindergarten entry. The program first targets "unserved" children (those not already being served in a preschool program) and secondly, "underserved" children (those eligible for but not receiving child care financial assistance and/or those in lower quality settings). The More at Four Program was initiated in the 2001-2002 school year, with sites first serving children in the spring of 2002, and programs in all 100 counties since the 2003-2004 school year. During the first four program years (2002-2005), More at Four served almost 32,000 children.

More at Four provides funding for classroom-based educational programs at a variety of sites designated by the local administration within each county or region (typically, either the local public school system or the local Smart Start partnership[1]). The programs are administered at the county or region (multi-county groupings) level, with oversight by the State More at Four Office, and must include collaboration among the local school system(s), the local Smart Start partnership, and other interested members of the early childhood community (e.g., Head Start, child care providers, resource and referral agencies). Eligibility for More at Four is based on income (up to 300% of Federal poverty status) and other risk factors (limited English proficiency, identified disability, chronic health conditions, and developmental/educational need). Priority for service is given first to children who are unserved in a preschool program at the time of enrollment, and second, to children who are underserved at enrollment (e.g., in a program but not receiving child care subsidy and/or in lower quality care). More at Four classrooms operate in a variety of settings, including public schools, Head Start, and community child care centers (both for-profit and nonprofit). Children may be enrolled in classrooms serving More at Four children exclusively or in blended classrooms serving children funded through other sources such as Head Start or parent fees. The programs operate on a school calendar basis for 6 to 6-1/2 hours/day and 180 days/year. Local sites must meet a variety of program guidelines and standards around curriculum, training and education levels for teachers and administrators, class size and student-teacher ratios, North Carolina child care licensing levels, and provision of other program services[2].

Overview of the Statewide Evaluation of the More at Four Program

Since its inception in 2002, the statewide evaluation of the More at Four Program has been conducted by the FPG Child Development Institute at the University of North Carolina-Chapel Hill. The current report describes the findings from a longitudinal follow-up of More at Four children recruited during their preschool year in 2003-2004 and followed into kindergarten in 2004-2005. (Separate reports of the preschool results for these children in year 3, as well as previous reports of the year 1 and year 2 evaluations are also available.[3, 4, 5]) The goal of this study was to provide information regarding the longer-term effectiveness of the program on children's readiness for and success in school.

The primary research questions addressed by this evaluation included:

- What were the longitudinal outcomes from pre-k through kindergarten for children who attended the More at Four Program?
- What factors were associated with better outcomes for children?

In order to better understand the longitudinal effects of participation in More at Four, we also examined the similarities and differences in programs as children made the transition from pre-k to kindergarten. Accordingly, the evaluation also addressed the following research question:

- What was the quality of the kindergarten programs attended by children in comparison to their pre-k experiences in More at Four?

In order to address these questions, we gathered information from individual child assessments and observations of classroom quality in pre-k and kindergarten, as well as demographic information from teacher surveys and monthly program service reports. A sample of 514 children was recruited from 58 randomly selected classrooms during their pre-k year in More at Four, and 348 of these children were followed into kindergarten. Individual assessments of children's language and literacy skills, math skills, general knowledge, and social skills were conducted near the beginning and end of their pre-k and kindergarten years to provide information about the amount of developmental growth experienced by children from the beginning of the More at Four Program through the end of kindergarten. Observations were conducted in a random sample of More at Four classrooms (n=99), including those attended by the sample children, and a random sample of the kindergarten classrooms attended by children the next year (n=97) to provide information about the global quality of classroom practices. In addition, demographic information about classroom characteristics and teacher qualifications were gathered from monthly service report data during More at Four and from teacher surveys during kindergarten. The monthly service report data from each local contractor provided information about both child and program characteristics during the More at Four year, including staff qualifications, children's levels on various risk factors, children's service priority status, and children's demographic characteristics.

Results

WHAT WERE THE LONGITUDINAL OUTCOMES FROM PRESCHOOL THROUGH KINDERGARTEN FOR CHILDREN WHO ATTENDED THE MORE AT FOUR PROGRAM?

In order to address questions about the longitudinal outcomes for children attending More at Four and factors associated with better outcomes, individual child assessments were conducted near the beginning and end of children's pre-k and kindergarten years. The child assessments included measures of children's language and literacy skills, math skills, general knowledge, and behavioral skills. Two sources of data were gathered: trained assessors administered measures of children's language/literacy skills, math skills, and general knowledge, and teachers completed ratings of children's behavioral skills. (See Table A1 in the appendix for an overview of these measures.)

These data provided information about the amount of developmental growth experienced by children from the beginning of the More at Four program through the end of kindergarten based on a number of widely-used measures. In accord with the overall goal of More at Four, the outcome areas measured were consistent with generally accepted definitions of school readiness, including the recommendations of the National Education Goals Panel.[6]

The original sample included 514 children recruited from 58 randomly selected More at Four classrooms in the fall of 2003. The preschool year assessments included 514 children in the fall of 2003 and 467 children in the spring of 2004. The kindergarten year assessments included 348 children in the fall of 2004 and 328 in the spring of 2005. (See Appendix A for more information about the child outcomes data collection.)

How much growth in developmental skills occurred for More at Four children in pre-k and kindergarten?

Children's scores on the various outcome measures at each of the four time periods are shown in Table 1 and Figures 1-9. As shown (see Table 1, overall change), children made substantial developmental progress from the beginning of pre-k to the end of kindergarten, with significant gains overall in all skill areas: language/literacy skills (receptive language, rhyming, literacy concepts, and naming letters); math skills (applied problems and counting); behavioral skills (social skills), and general knowledge (social awareness and color naming). These gains are especially notable on two standardized measures, receptive language and applied math skills, where children exhibited sustained growth over time beyond the expected increases in knowledge with increasing age. For these standardized measures, children's scores can be compared to the population mean (i.e., score of 100). In the case of receptive language, children moved from one standard deviation below the mean (mean score of 85) at entry into pre-k to slightly below the mean at the end of kindergarten (mean score of 96). For math skills, children progressed from approximately one-half a standard deviation below the mean at entry into pre-k (mean score of 93) to scoring at the population mean (mean score of 100) by the end of kindergarten. The one area that showed no changes over

time was problem behaviors, which remained just below the population average of 100 at all time points (lower scores represent fewer problem behaviors), indicating that the level of problem behaviors was in the typical range for More at Four children during both pre-k and kindergarten.

For most areas of language/literacy skills (receptive language, rhyming, and literacy concepts), math skills (applied problems and counting), and behavioral skills (social skills and problem behaviors), we were able to independently examine whether children made significant progress each year, within pre-k and within kindergarten (see Table 1, fall to spring change). These results indicated a similar pattern to the overall longitudinal findings, with significant growth each year (pre-k and kindergarten) for all areas but problem behaviors, which remained consistently at the expected level each year. These findings suggest that the gains children made in pre-k were sustained through entry into kindergarten and that children continued to exhibit growth in each of these areas through the end of their first year in elementary school.

For the remaining measures (letter naming, color knowledge, and social awareness), we were not able to statistically examine the gains in kindergarten because most children were scoring at or near the ceiling (maximum score) either at entry into kindergarten (color knowledge and social awareness) or by the end of kindergarten (letter naming). This pattern of results indicates that children who attended the More at Four Program in pre-k had mastered these basic skills by entry into or at the end of kindergarten. These skills, such as knowing the alphabet, knowing colors, and knowing one's name and birth date, are important foundations for children's academic success in school.

Table 1. Pre-k and Kindergarten Mean Scores on Child Outcome Measures[1]

Domain	Outcome	Pre-k 2003-2004			Kindergarten 2004-2005			Overall Change
		Fall Pre-k (n=453-514) **Mean** (SD) Range	**Spring Pre-k** (n=419-466) **Mean** (SD) Range	**Pre-k Fall-Spring Change Sig. Level[3]**	**Fall K** (n=311-348) **Mean** (SD) Range	**Spring K** (n=299-327) **Mean** (SD) Range	**K Fall-Spring Change Sig. Level[4]**	**Sig. Level[2]**
Language and literacy	PPVT-III receptive language[5]	**85.4** (19.3) 40-124	**89.9** (17.2) 40-126	***	**94.7** (15.9) 40-127	**96.3** (13.8) 40-132	**	***
	WJ-III Rhyming[6]	**1.9** (2.7) 0-15	**4.4** (4.1) 0-15	***	**6.6** (4.4) 0-16	**8.7** (4.5) 0-17	***	***
	Story and Print Concepts[7]	**3.0** (2.2) 0-10	**4.9** (2.6) 0-12	***	**7.3** (2.4) 0-14	**9.1** (2.4) 1-14	***	***
	Naming Letters[8]	**6.1** (7.9) 0-26	**15.1** (9.5) 0-26	***	**21.4** (7.1) 0-26	**24.7** (4.0) 2-26	--	***
Math	WJ-III Applied Problems[5]	**93.1** (15.0) 46-128	**94.0** (13.9) 51-124	**	**97.2** (12.1) 46-131	**99.9** (11.1) 60-131	***	***
	Counting Task[9]	**11.8** (8.1) 1-40	**18.9** (11.5) 1-40	***	**28.2** (11.9) 1-40	**33.7** (9.4) 1-40	***	***

[1] *p < .05, **p < .01, ***p <.001
[2] Repeated measures analyses using a general linear models approach were conducted to test whether there were significant gains in scores over the four time periods, adjusting for classroom.
[3] Repeated measures analyses using general linear models were conducted to test whether fall and spring scores were significantly different, adjusting for classroom.
[4] Repeated measures analyses using general linear models were conducted to test whether fall and spring scores were significantly different, adjusting for classroom.
[5] Indicates standardized, norm-referenced measure with mean=100, SD=15.
[6] Possible range =0-17
[7] Possible range =0-14
[8] Possible range =0-26
[9] Possible range =1-40

Table 1. Pre-k and Kindergarten Mean Scores on Child Outcome Measures[10]
(continued)

Domain	Outcome	Pre-k 2003-2004			Kindergarten 2004-2005			Overall Change
		Fall Pre-k (n=453-514) **Mean** (SD) Range	**Spring Pre-k** (n=419-466) **Mean** (SD) Range	**Pre-k Fall-Spring Change Sig. Level[12]**	**Fall K** (n=311-348) **Mean** (SD) Range	**Spring K** (n=299-327) **Mean** (SD) Range	**K Fall-Spring Change Sig. Level[13]**	**Sig. Level[11]**
Classroom behavior	SSRS Social Skills[14]	**101.2** (16.0) 54-130	**108.3** (15.9) 60-130	***	**101.6** (14.3) 64-130	**106.4** (14.3) 61-130	***	***
	SSRS Problem Behaviors	**98.6** (11.9) 85-138	**99.3** (12.8) 85-145	NS	**98.9** (12.8) 85-135	**99.0** (13.0) 85-137	NS	NS
General knowledge	Social Awareness[15]	**3.7** (1.8) 0-6	**4.5** (1.5) 0-6	***	**4.8** (1.2) 1-6	**5.4** (1.0) 1-6	--	***
	Color Naming[16]	**16.3** (5.6) 0-20	**18.8** (2.7) 3-20	***	**19.7** (1.3) 2-20	**19.9** (0.4) 17-20	--	***

[10] *$\underline{p}$ < .05, **$\underline{p}$ < .01, ***$\underline{p}$ <.001
[11] Repeated measures analyses using a general linear models approach were conducted to test whether there were significant gains in scores over the four time periods, adjusting for classroom.
[12] Repeated measures analyses using general linear models were conducted to test whether fall and spring scores were significantly different, adjusting for classroom.
[13] Repeated measures analyses using general linear models were conducted to test whether fall and spring scores were significantly different, adjusting for classroom.
[14] Indicates standardized, norm-referenced measure with mean=100, SD=15.
[15] Possible range =0-6
[16] Possible range =0-20

Figure 1. Preschool to Kindergarten PPVT-III Standard Scores[1]

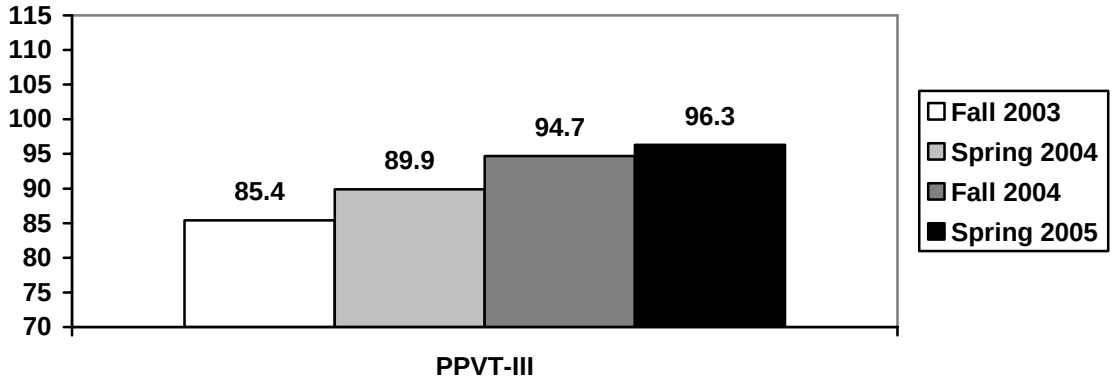


Figure 2. Preschool to Kindergarten WJ-III Rhyming Raw Scores[2]

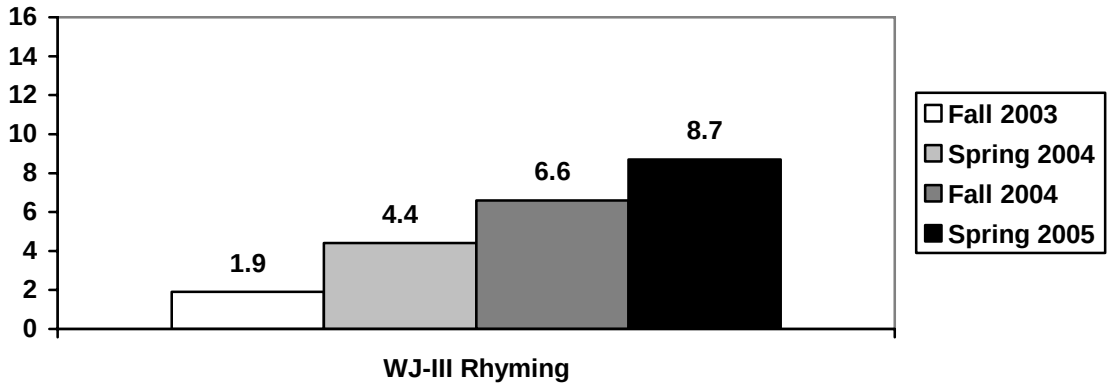
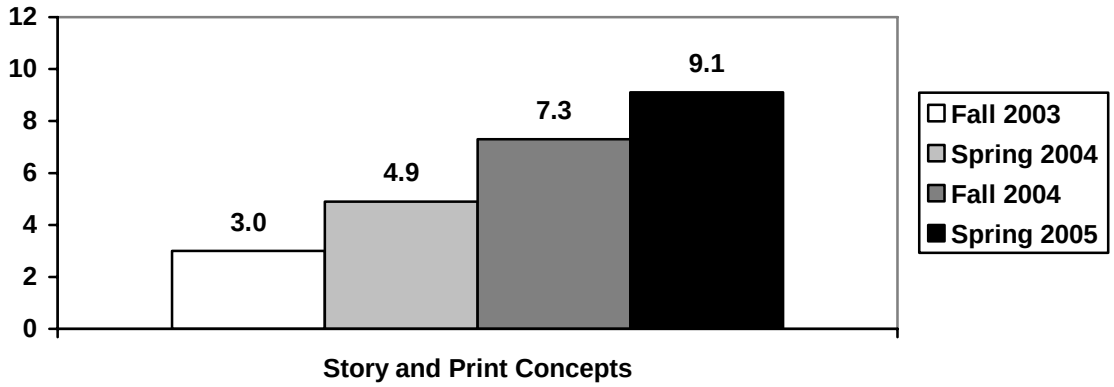


Figure 3. Preschool to Kindergarten Story and Print Concepts Raw Scores[3]



[1] Note: General Population Norm=100.
[2] Note: Maximum Score=17.
[3] Note: Maximum Score=14.

Figure 4. Preschool to Kindergarten Naming Letters Raw Scores[1]

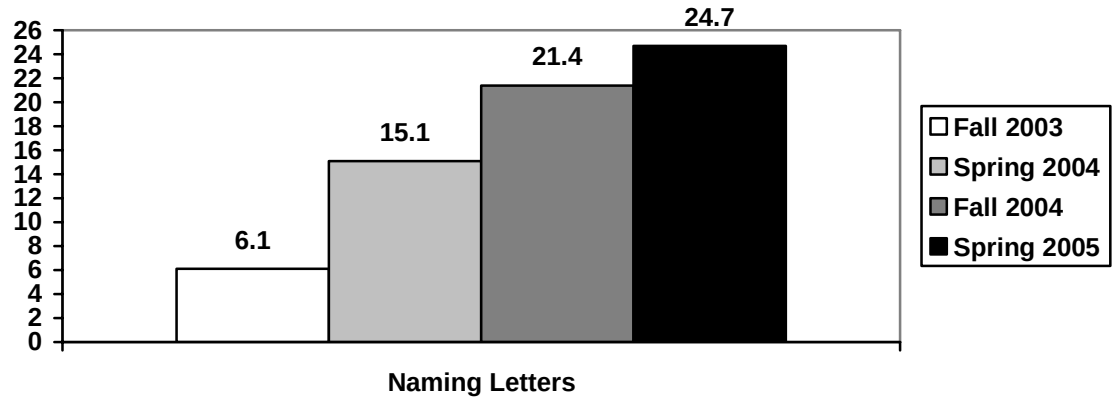


Figure 5. Preschool to Kindergarten WJ-III Applied Problems Standard Scores[2]

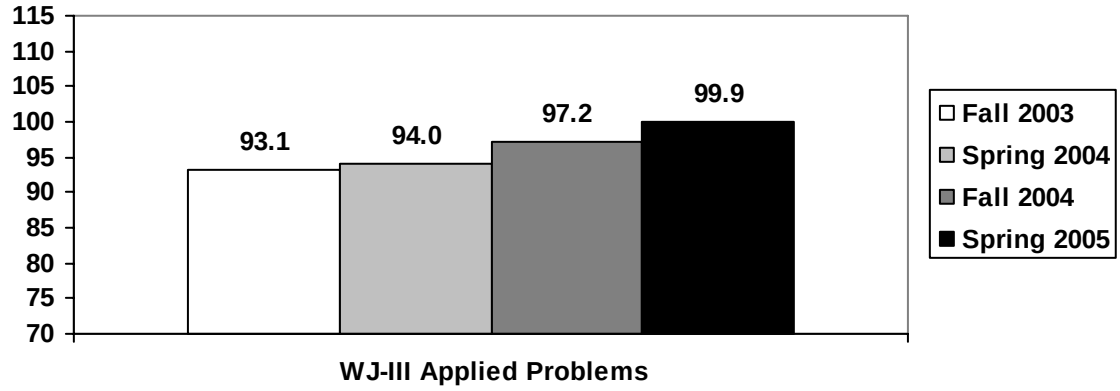
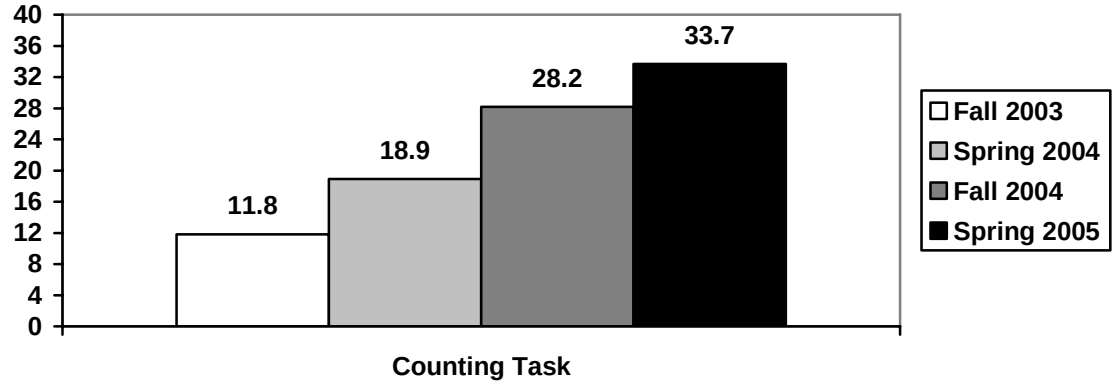


Figure 6. Preschool to Kindergarten Counting Task Raw Scores[3]



[1] Note: Maximum Score=26.
[2] Note: General Population Norm=100.
[3] Note: Maximum Score=40.

Figure 7. Preschool to Kindergarten SSRS Social Skills and Problem Behavior Standard Scores[1]

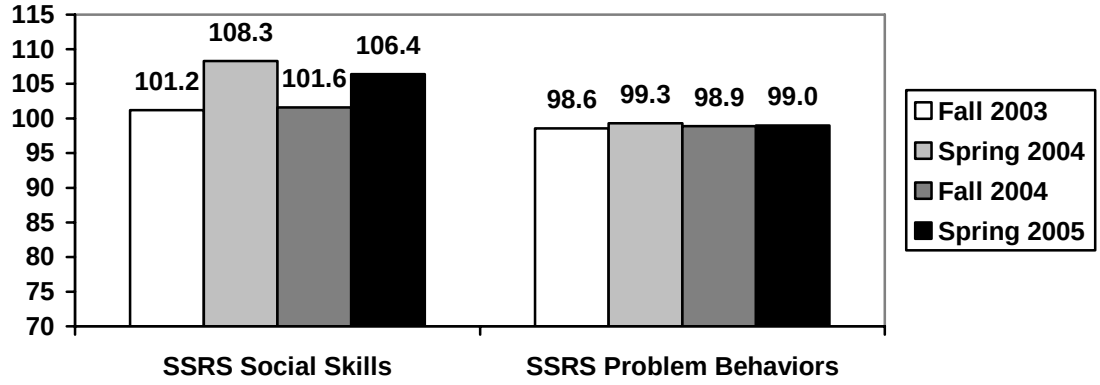


Figure 8. Preschool to Kindergarten Social Awareness Raw Scores[2]

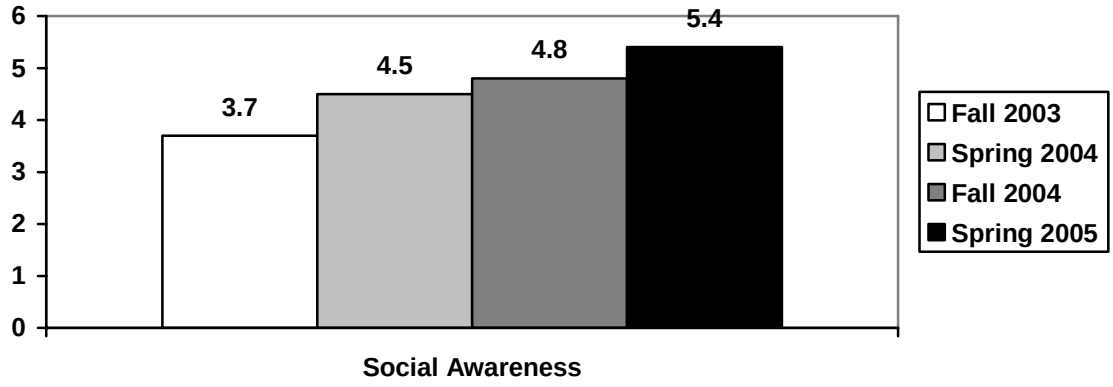
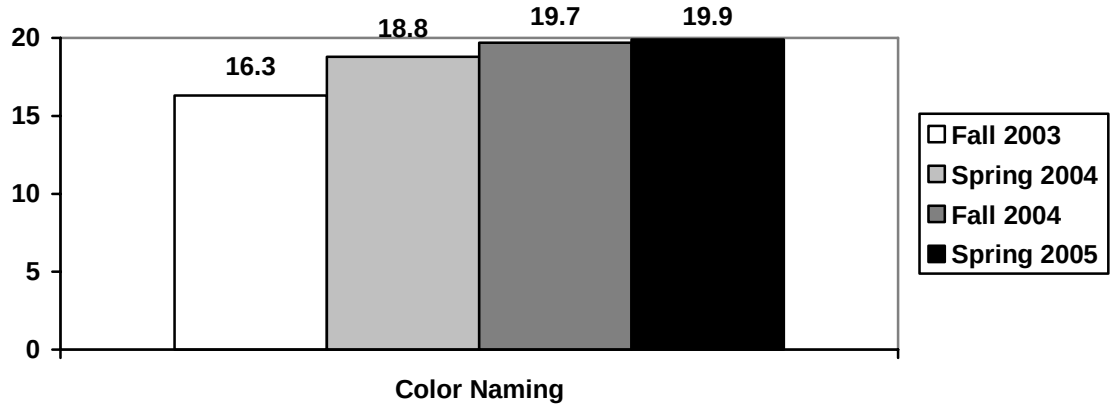


Figure 9. Preschool to Kindergarten Color Naming Raw Scores[3]



[1] Note: General Population Norm=100.
[2] Note: Maximum Score=6.
[3] Note: Maximum Score=20.

Are there differences in the amount of children's growth in pre-k versus kindergarten?

We examined the extent to which the amount of growth in developmental skills was similar during the pre-k and kindergarten years for language/literacy skills (receptive language, rhyming, and literacy concepts), math skills (applied problems and counting), and behavioral skills (social skills and problem behaviors). We were not able to examine the remaining measures (letter naming, color knowledge, and social awareness) because the distributions were too skewed, with most children scoring at or near the ceiling in kindergarten. While children showed gains in all basic skill areas over the entire period, children made significantly greater progress in receptive language skills (PPVT-III) during the pre-k than the kindergarten year [$F(1, 1094)=11.48$, $p=.0007$]. There were no differences in the amount of growth in pre-k compared to kindergarten for other areas of language/literacy skills (rhyming and literacy concepts), math skills (applied problems and counting), or behavioral skills (social skills and problem behaviors). However, as noted earlier, during both years, children's spring scores were significantly higher than their previous fall scores in each of these areas (except problem behaviors), indicating that significant growth was occurring in each program (pre-k and kindergarten), as well as over the entire period.

Analytic Strategy: A series of analyses was conducted to examine children's growth over time from the beginning of pre-k to the end of kindergarten, as well as to examine growth separately within the pre-k and the kindergarten years. Separate repeated measures analyses using a general linear models approach were conducted for each outcome measure, with scores at all four time points (fall pre-k, spring pre-k, fall kindergarten, spring kindergarten) as the dependent variables to examine changes in overall growth from the beginning of pre-k to the end of kindergarten. These analyses adjusted for classroom, to account for data from multiple children within the same classroom. The tests of overall change were assessed by an overall F test for the model, while the tests for differences in the amount of growth in pre-k versus kindergarten were assessed by post-hoc contrasts comparing the differences in scores at time 1 and 2 (fall pre-k and spring pre-k) and the differences at time 3 and 4 (fall kindergarten and spring kindergarten). Parallel analyses were conducted including outcome scores from only two time points to independently test growth within the pre-k year (time 1 and 2) or kindergarten year (time 3 and 4).

An additional set of analyses was conducted to insure that these findings were not due to other factors. These same analyses were conducted only including children with data from all four time points to test whether there were any differences in the results for children who were and were not followed into kindergarten. There were no differences in the findings when only children with complete data were included, suggesting that there were no differential attrition effects in the sample. Table B1 in the Appendix contains the means on each outcome measure at each time and significance levels for the tests of overall change and change each year for the subsample of children with complete data.

WHAT FACTORS ARE ASSOCIATED WITH BETTER OUTCOMES FOR CHILDREN?

We conducted a series of analyses to examine whether certain child or classroom characteristics were associated with children making greater gains from pre-k through kindergarten for language/literacy skills (receptive language, rhyming, and literacy concepts), math skills (applied problems and counting), and behavioral skills (social skills and problem behaviors). In particular, we tested whether children at greater risk at entry into the pre-k program, as measured by higher risk factor totals,[7] higher service priority status for More at Four,[8] or lower levels of English proficiency,[9] gained more from the beginning of pre-k to the end of kindergarten. Similarly, we examined whether children who attended higher quality classrooms in pre-k or kindergarten made greater developmental progress than children in lower quality classrooms, after adjusting for individual child risk characteristics. We also examined whether other factors, such as pre-k program dosage, the timing of assessments, or summer effects accounted for differences in children's growth.

Do children at greater risk evidence greater developmental growth during pre-k and kindergarten?

Differences in children's outcomes on the basis of three risk status factors at entry into pre-k (total risk factor level, service priority level, and English proficiency level) were examined to see whether level of risk was related to the amount of gain in developmental skills over pre-k and kindergarten, adjusting for children's gender and age. As shown in Table 2, children at greater risk showed greater gains in some language/literacy skills and math skills, suggesting that the primary target groups for the More at Four Program benefited even more from participation in these early education programs. The standardized effect sizes for these differences were in the moderate to large range, indicating that these were meaningful differences on these outcome measures. The greatest differences were found for children with lower levels of English proficiency. Children at lower levels of English proficiency showed greater gains over this 2-year period in receptive language, math skills, and literacy concepts compared to children with higher English proficiency levels. For example, Figures 10 and 11 compare the growth rates in receptive language and math skills from the beginning of pre-k through the end of kindergarten for children at the lowest (fluency level 1) and highest (fluency level 5) English proficiency levels, indicating greater growth for children with lower English proficiency. In the case of literacy concepts, the greatest differences were found for children with limited English proficiency (fluency level 3) compared to those who were English proficient (fluency level 5), as seen in Figure 12. Even though their scores were slightly to somewhat lower than their peers, children with lower English proficiency were progressing at a slightly faster rate during the pre-k and kindergarten program years. In contrast, children with lower levels of English proficiency (e.g., fluency levels 1 vs. 5) made fewer gains in rhyming through the end of kindergarten, a more advanced phonological awareness skill which is related to early reading skills (see Figure 13). These findings

suggest that these children were scoring substantially lower on rhyming skills than their more English proficient peers, and were progressing at a slower rate.

Similar differences in growth in receptive language were found on the basis of overall risk. For example, as illustrated in Figure 14, children with higher overall risk totals (e.g., 90th percentile, corresponding to risk factor scores of 4) showed greater gains in receptive language than their peers at lower risk (e.g., 10th percentile, corresponding to risk factor scores of 0) from the beginning of pre-k through the end of kindergarten, although they were still scoring slightly lower by the end of kindergarten. There were no differences in children's growth in social skills from pre-k through kindergarten on the basis of risk levels. However, children with higher total risk factor scores showed slightly greater increases in problem behaviors (higher scores), especially after they entered kindergarten (see Figure 15). While there was not an overall pattern of growth in problem behaviors across all children, there was a significant difference in the pattern of change for lower and higher risk children, perhaps suggesting that children at higher risk were having greater difficulty adapting to the behavioral demands of kindergarten classrooms.

As seen in Figure 16, children at lower levels of service priority status (e.g., 10^{th} percentile, service priority level of 3) also showed somewhat greater increases in problem behaviors in kindergarten compared to children at higher levels of service priority status (e.g., 50^{th}-90^{th} percentile, service priority level of 6). Lower service priority levels represented children who were "underserved" at the time of entry into More at Four (i.e., those who were participating in other, often lower quality, child care programs) while higher service priority levels represented children who were "unserved" at the time of entry into More at Four (i.e., not participating in a formal child care program). Children at lower levels of service priority would be likely to have had more, and often lower quality, child care experiences than higher service priority children. This finding is consistent with other research which suggests that children with more center-based child care experiences exhibit slightly higher levels of problem behaviors, although these differences tend to disappear by middle elementary school.[10, 11] However, the effect sizes for problem behaviors were fairly modest, suggesting that the changes over time, as well as the differences between groups, were much weaker than those found for other outcome measures.

Analytic Strategy: For each outcome measure, we conducted separate repeated measures analyses using general linear models. The analyses included children's gender and age at each assessment as covariates. The analyses also adjusted for children's risk status (risk factor level, service priority level, and English proficiency level), and tested the interactions of each of the risk status variables with time to examine whether they exhibited any moderating effects on the amount of growth. We also tested these same models adding pre-k quality (ECERS-R total child items score) as a covariate, to adjust for the quality of children's experiences in More at Four, and found no differences in the pattern of effects.

Table 2. Child Characteristics Related to Gains from Pre-kindergarten to Kindergarten

Domain	Outcomes	Significant Predictors	Predictor Values	Standardized Effect Sizes[1]
Language and literacy	PPVT-III Receptive Language	English Proficiency[2]	Low	4.39
			High	2.32
		Risk Factor Total[3]	Low	3.26
			High	3.33
	WJ-III Rhyming	English Proficiency[2]	Low	1.26
			High	2.76
	Story and Print Concepts	English Proficiency[4]	Low	3.60
			High	2.97
Math	WJ-III Applied Problems	English Proficiency[2]	Low	3.91
			High	2.55
Social skills	SSRS Problem Behaviors	Risk Factor Total[3]	Low	0.28
			High	0.75
		Service Priority Status[5]	Low	0.85
			High	0.39

[1] Effect size was computed as the calculated change scores from time 1 to time 4 (difference between spring kindergarten scores and fall pre-k scores) for the corresponding values of the predictor divided by the square root of the model residual error (RMSE).
[2] For this measure, low and high values of English proficiency were calculated at fluency levels 1 and 5.
[3] For this measure, low and high values of risk factor total were calculated at the 10th percentile (total score of 0) and 90th percentile (total score of 4).
[4] For this measure, low and high values of English proficiency were calculated at fluency levels 3 and 5.
[5] For this measure, low and high values of service priority status were calculated at the 10th (level 3) and 50th-90th percentile (level 6).

Figure 10. Growth in Receptive Language Skills (PPVT-III) for Children with Low vs. High English Proficiency (adjusted for other child characteristics)

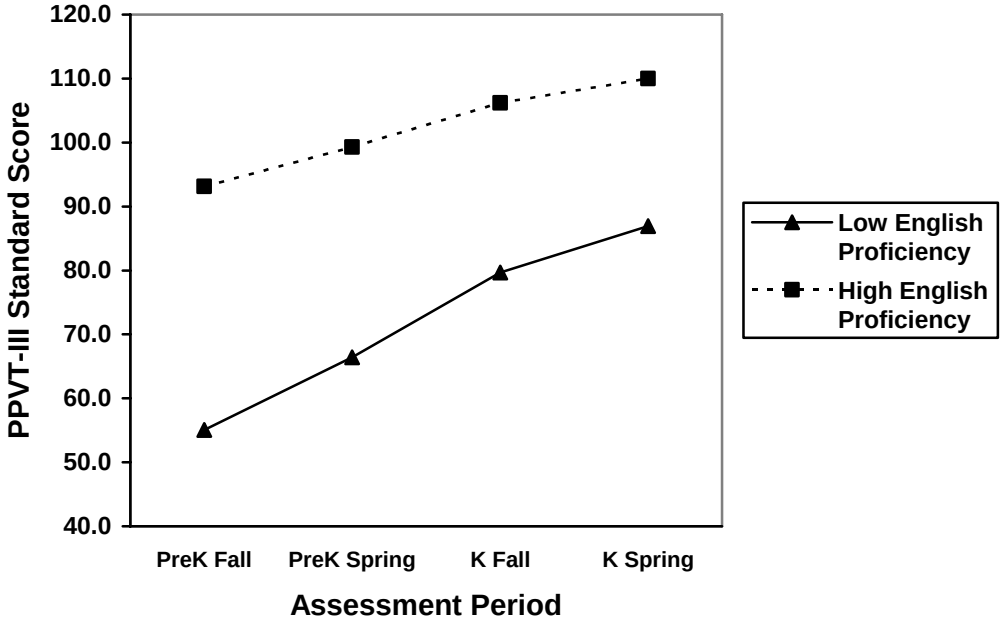


Figure 11. Growth in Math Skills (WJ-III Applied Problems) for Children with Low vs. High English Proficiency (adjusted for other child characteristics)

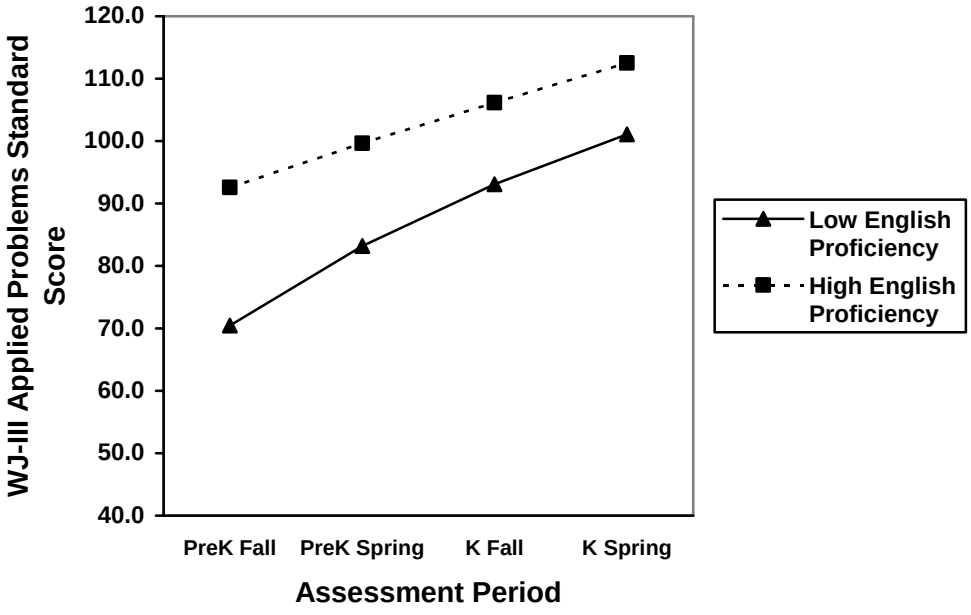


Figure 12. Growth in Pre-literacy Skills (Story and Print Concepts) for Children with Low vs. High English Proficiency (adjusted for other child characteristics)

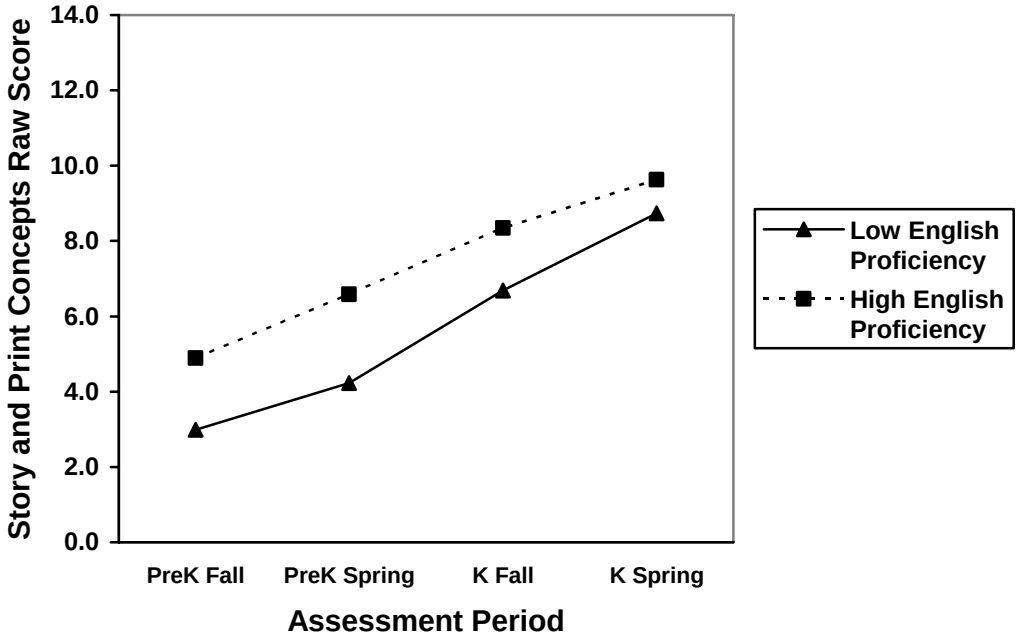


Figure 13. Growth in Phonological Awareness Skills (WJ-III Rhyming) for Children with Low vs. High English Proficiency (adjusted for other child characteristics)

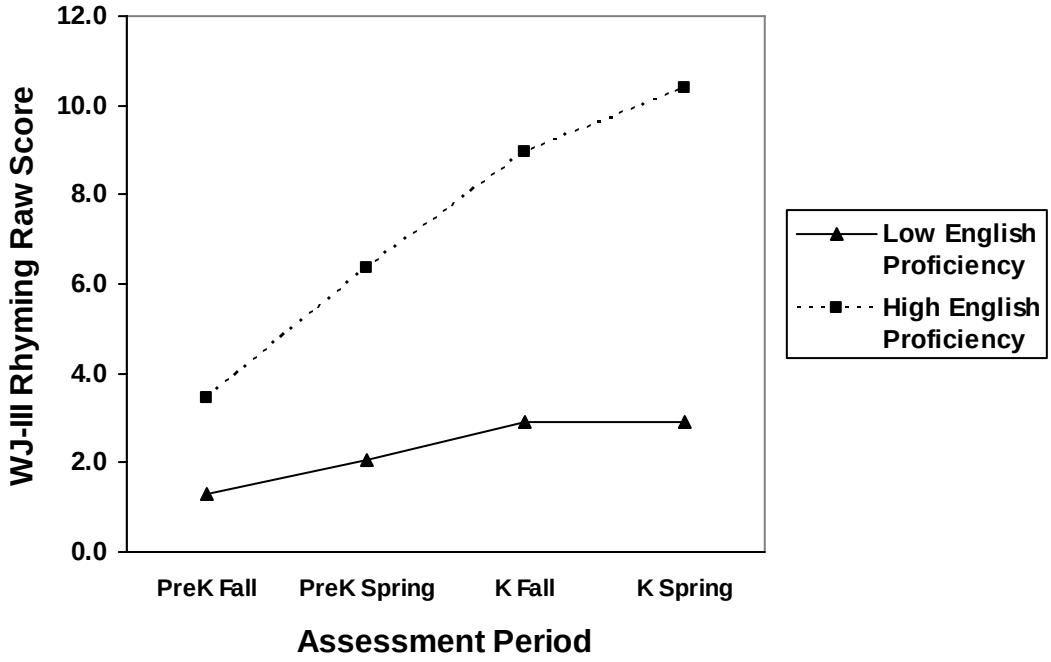


Figure 14. Growth in Receptive Language Skills (PPVT-III) for Children with Low vs. High Risk Factor Scores (adjusted for other child characteristics)

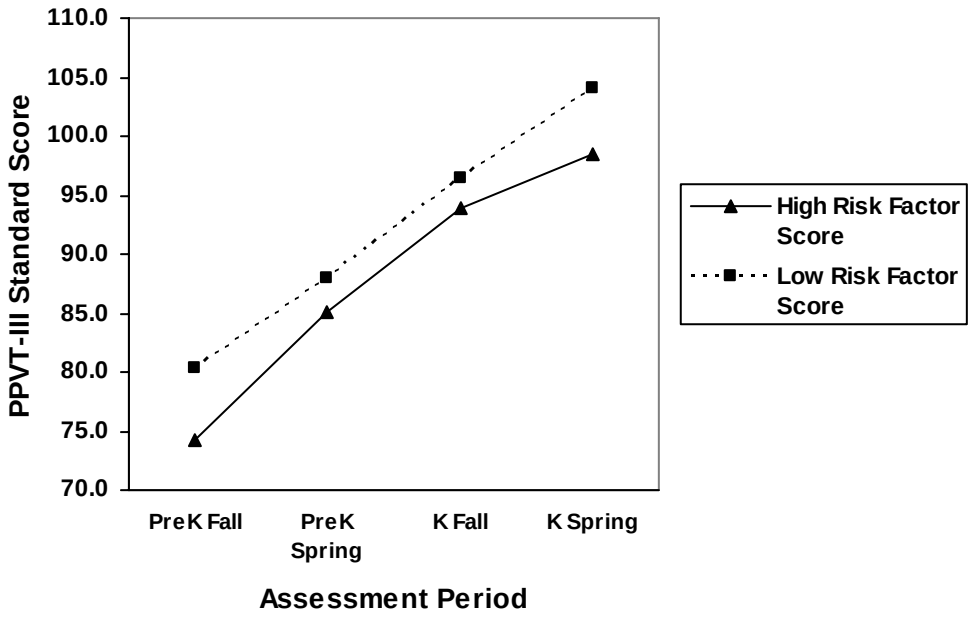
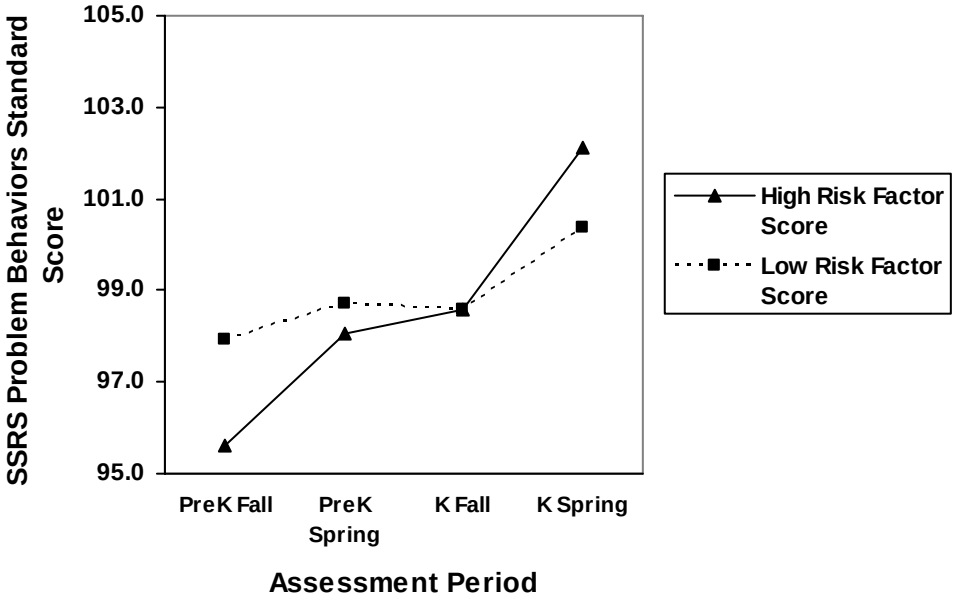
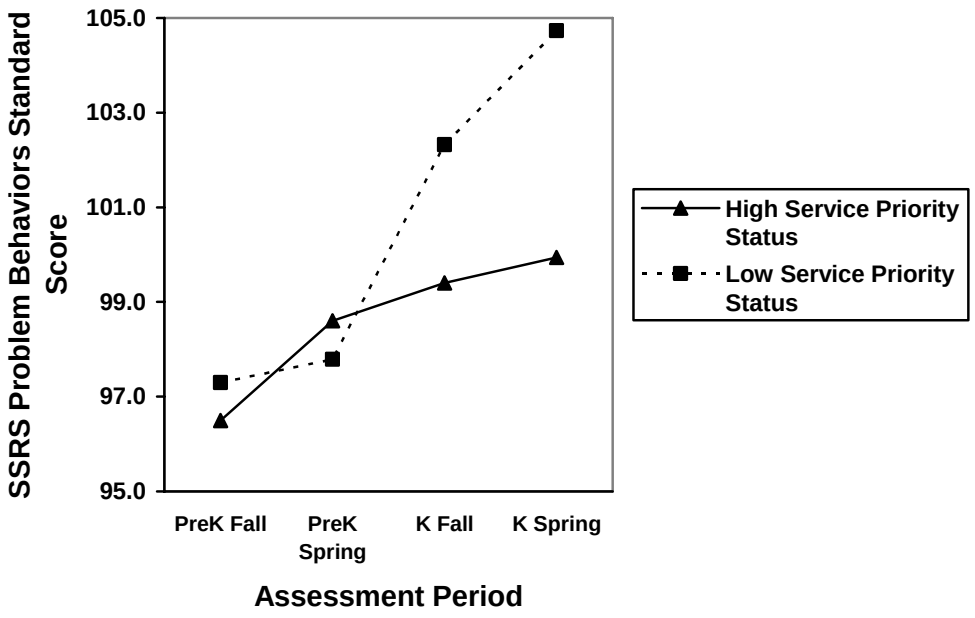


Figure 15. Changes in Problem Behaviors (SSRS)[1] for Children with Low vs. High Risk Factor Scores (adjusted for other child characteristics)



[1] Higher scores on the SSRS Problem Behaviors scale indicate a higher frequency of problem behaviors.

Figure 16. Changes in Problem Behaviors (SSRS)[1] for Children with Low vs. High Service Priority Status (adjusted for other child characteristics)



[1] Higher scores on the SSRS Problem Behaviors scale indicate a higher frequency of problem behaviors.

Are there cumulative effects of risk on children's outcomes in pre-k and kindergarten?

In order to further illustrate the differences related to risk factors, we examined the performance at each of the four assessment periods for children at four different levels of risk (with risk factor scores of 0, 1, 2, and 3 or higher)[12]. As seen in Table 3, scores on the outcome measures tended to decrease as children's risk group increased. While children in all risk groups progressed over time, the scores remained substantially lower for children with scores in the highest risk group. However, the highest risk group also made greater progress over time on some measures. The highest risk children scored significantly lower than children in the other three groups on most of the language and literacy measures (receptive language, rhyming, literacy concepts), math skills (applied problems), and general knowledge (social awareness) at all four time points. For some measures, these children caught up to the other groups by the beginning of kindergarten (color knowledge) or by the end of kindergarten (letter knowledge, counting). For some of the language/literacy measures (receptive language, rhyming, literacy concepts), children in the next higher risk group(s) also scored lower than children in the lowest risk group at the beginning of the pre-k program, but had caught up by the end of pre-k. In comparison to the lowest risk group, children at highest risk gained more over time on several of the measures of language and literacy skills (receptive language, naming letters), math skills (applied problems), and general knowledge (social awareness, color knowledge), as seen in Figures 17-21. The converse was true for rhyming, a high level phonological awareness skill, where children at the least risk gained more over this time period than children in the highest risk group (see Figure 22). There were no differences among the groups in measures of behavioral skills, both for social skills and problem behaviors. These findings suggest that while children in all groups made advances during the pre-k and kindergarten years, many of the deficits in skills faced by children at the very greatest risk were not fully eradicated even by the end of kindergarten.

Analytic Strategy: Separate repeated measures analyses using a general linear models approach were conducted for each outcome measure, with scores at all four time points (fall pre-k, spring pre-k, fall kindergarten, spring kindergarten) as the dependent variables to examine changes in overall growth from the beginning of pre-k to the end of kindergarten. The analyses included the total risk factor score as a categorical predictor with four levels (0, 1, 2, and 3 or greater) and the interaction between risk factor level and time to test whether there were any associations between risk factor and children's level of performance or amount of gain on the outcome measures. Post-hoc contrasts were performed for all pairwise comparisons among the four risk factor levels within each time point, resulting in 24 contrasts for each outcome measure. As a precaution against Type I error, the *p*-value for all contrasts was adjusted using the Bonferroni method, and only comparisons of $p<.002$ (i.e., .05/24=.002) were considered significant. In addition, pairwise contrasts of the risk factor level by time interaction were performed for the lowest (0) and highest (3+) risk factor groups to test differences in the amount of gain over time.

Table 3. Child Outcomes from Preschool to Kindergarten by Risk Factor Levels[1]

Outcome	Risk Total Group	N	Pre-k 2003-2004		Kindergarten 2004-2005	
			Fall Pre-k	Spring Pre-k	Fall K	Spring K
			Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Language and literacy						
PPVT-III receptive language[2]	0	29-38	**98.7** (15.4)	**97.4** (12.2)	**101.5** (13.1)	**103.4** (9.4)
	1	42-68	**93.1** (13.1)	**96.6** (12.0)	**98.1** (16.2)	**102.2** (9.6)
	2	191-304	**88.7** (15.0)	**92.9** (14.2)	**97.4** (13.2)	**98.7** (11.5)
	3+	63-93	**63.2** (20.4)	**72.0** (19.5)	**80.8** (17.1)	**81.9** (14.4)
	Sig[3]:		3<0,1,2 2<0	3<0,1,2	3<0,1,2	3<0,1,2
WJ-III Rhyming[4]	0	29-37	**3.8** (4.0)	**6.5** (4.9)	**7.6** (4.2)	**10.6** (3.5)
	1	42-65	**2.0** (2.5)	**4.4** (4.1)	**7.1** (4.9)	**9.9** (4.5)
	2	191-301	**1.9** (2.6)	**4.8** (4.2)	**7.0** (4.4)	**9.1** (4.3)
	3+	62-72	**0.5** (1.1)	**1.9** (2.2)	**4.5** (3.7)	**5.8** (4.4)
	Sig[3]:		3<0,1,2 2<0 1<0	3<0,1,2	3<0,1,2	3<0,1,2

[1] A total risk factor score was constructed based on the 2003-2004 More at Four eligibility guidelines, using income (eligibility for free lunch =2 points, reduced-price lunch =1 point, and full-price lunch=0 points) and additional risk factors (1 point each for limited English proficiency, identified disability, and chronic health condition). A four-level categorical variable was constructed, representing risk factor scores of 0, 1, 2, and 3-5.
[2] Indicates standardized, norm-referenced measure with mean=100, SD=15.
[3] Significance comparisons represent summary of pairwise differences between risk total groups.
[4] Possible range=0-17

Table 3. Child Outcomes from Preschool to Kindergarten by Risk Factor Levels (*continued)*

Outcome	Risk Total Group	N	Pre-k 2003-2004		Kindergarten 2004-2005	
			Fall Pre-k	Spring Pre-k	Fall K	Spring K
			Mean (SD)	**Mean** (SD)	**Mean** (SD)	**Mean** (SD)
Story and Print Concepts[5]	0	29-38	**4.5** (2.4)	**6.3** (2.5)	**8.2** (1.7)	**9.8** (2.1)
	1	42-66	**3.5** (2.3)	**5.5** (2.9)	**7.2** (2.7)	**9.4** (2.6)
	2	192-305	**3.0** (2.1)	**5.0** (2.4)	**7.5** (2.3)	**9.4** (2.2)
	3+	63-77	**1.9** (1.8)	**3.9** (2.6)	**6.3** (2.5)	**7.9** (2.4)
	Sig[3]:		3<0,1,2 2<0	3<0,1,2	3<0,2	3<0,1,2
Naming Letters[6]	0	29-38	**9.8** (9.7)	**17.4** (9.2)	**23.8** (4.7)	**25.3** (2.1)
	1	42-66	**7.0** (9.0)	**15.7** (9.0)	**21.6** (6.6)	**24.5** (4.5)
	2	192-307	**6.4** (7.7)	**15.9** (9.5)	**21.9** (6.8)	**24.9** (3.7)
	3+	62-95	**3.0** (5.9)	**11.1** (9.2)	**18.8** (8.7)	**24.0** (4.9)
	Sig[3]:		3<0,1,2	3<0,1,2	3<0,2	NS

[5] Possible range =0-14
[6] Possible range =0-26

Table 3. Child Outcomes from Preschool to Kindergarten by Risk Factor Levels *(continued)*

Outcome	Risk Total Group	N	Pre-k 2003-2004		Kindergarten 2004-2005	
			Fall Pre-k	Spring Pre-k	Fall K	Spring K
			Mean (SD)	**Mean** (SD)	**Mean** (SD)	**Mean** (SD)
Math						
WJ-III Applied Problems[7]	0	29-37	**100.0** (14.5)	**99.3** (11.2)	**101.7** (11.3)	**101.2** (9.9)
	1	42-63	**98.8** (12.9)	**97.0** (14.1)	**101.4** (10.7)	**103.4** (9.3)
	2	188-293	**93.5** (13.6)	**95.3** (13.2)	**98.0** (10.9)	**100.9** (10.4)
	3+	58-76	**79.8** (16.6)	**85.1** (13.8)	**90.1** (14.0)	**94.2** (12.8)
	Sig[3]:		3<0,1,2	3<0,1,2	3<0,1,2	3<0,1,2
Counting Task[8]	0	29-36	**16.4** (9.7)	**21.4** (12.0)	**32.5** (10.0)	**36.3** (7.7)
	1	42-64	**12.4** (6.1)	**19.4** (12.3)	**27.6** (12.8)	**34.7** (8.5)
	2	192-297	**12.3** (8.5)	**20.0** (11.8)	**29.4** (11.4)	**33.9** (9.4)
	3+	63-79	**7.8** (4.7)	**13.6** (8.3)	**23.0** (12.3)	**31.3** (10.5)
	Sig[3]:		3<0,1,2	3<0,1,2	3<0,2	NS

[7] Indicates standardized, norm-referenced measure with mean=100, SD=15.
[8] Possible range =1-40

Table 3. Child Outcomes from Preschool to Kindergarten by Risk Factor Levels *(continued)*

Outcome	Risk Total Group	N	Pre-k 2003-2004		Kindergarten 2004-2005	
			Fall Pre-k	Spring Pre-k	Fall K	Spring K
			Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Classroom Behavior						
SSRS Social Skills[9]	0	25-38	**105.6** (13.6)	**109.1** (15.7)	**105.9** (15.3)	**111.2** (16.9)
	1	38-68	**101.1** (16.9)	**106.2** (15.1)	**99.9** (15.3)	**107.6** (17.5)
	2	175-306	**101.2** (14.6)	**108.4** (14.0)	**102.1** (13.4)	**106.0** (13.3)
	3+	61-97	**99.5** (16.2)	**108.0** (18.1)	**99.2** (15.1)	**104.9** (13.7)
	Sig[3]:		NS	NS	NS	NS
SSRS Problem Behaviors[9]	0	24-39	**100.7** (12.4)	**98.7** (13.6)	**96.5** (12.1)	**97.4** (15.0)
	1	38-67	**99.1** (12.6)	**101.5** (12.9)	**99.1** (13.9)	**99.9** (14.7)
	2	175-307	**98.2** (11.9)	**99.0** (12.6)	**98.5** (12.2)	**99.4** (12.5)
	3+	61-97	**98.6** (11.5)	**98.2** (12.8)	**101.3** (14.0)	**98.4** (12.7)
	Sig[3]:		NS	NS	NS	NS

[9] Indicates standardized, norm-referenced measure with mean=100, SD=15.

Table 3. Child Outcomes from Preschool to Kindergarten by Risk Factor Levels *(continued)*

Outcome	Risk Total Group	N	Pre-k 2003-2004		Kindergarten 2004-2005	
			Fall Pre-k	Spring Pre-k	Fall K	Spring K
			Mean (SD)	**Mean** (SD)	**Mean** (SD)	**Mean** (SD)
General knowledge						
Social Awareness[10]	0	29-39	**4.6** (1.6)	**5.3** (1.1)	**5.3** (1.0)	**5.8** (0.5)
	1	42-68	**4.2** (1.4)	**5.0** (1.2)	**4.9** (1.0)	**5.5** (0.9)
	2	192-308	**4.0** (1.6)	**4.6** (1.4)	**5.0** (1.2)	**5.5** (1.0)
	3+	63-97	**1.9** (1.5)	**3.3** (1.6)	**4.2** (1.3)	**4.8** (1.1)
	Sig[3]:		3<0,1,2	3<0,1,2	3<0,1,2	3<0,1,2
Color Naming[11]	0	29-39	**18.5** (2.4)	**19.7** (0.6)	**19.7** (0.8)	**20.0** (0.0)
	1	42-68	**18.0** (3.9)	**19.3** (2.0)	**19.8** (0.6)	**19.9** (0.3)
	2	191-308	**17.2** (4.9)	**18.9** (2.5)	**19.7** (1.0)	**19.9** (0.4)
	3+	63-96	**11.4** (6.9)	**17.6** (3.7)	**19.5** (2.3)	**19.9** (0.4)
	Sig[3]:		3<0,1,2	3<0,1,2	NS	NS

[10] Possible range =0-6
[11] Possible range =0-20

Figure 17. Growth in Receptive Language Skills (PPVT-III) by Cumulative Risk

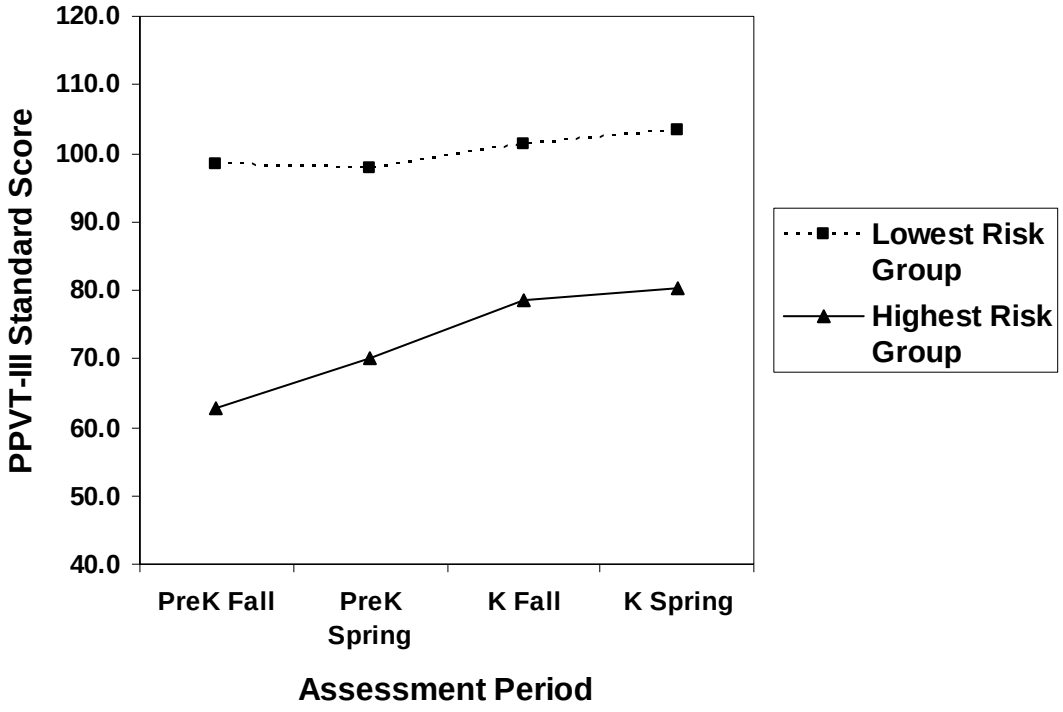


Figure 18. Growth in Alphabet Knowledge (Naming Letters Task) by Cumulative Risk

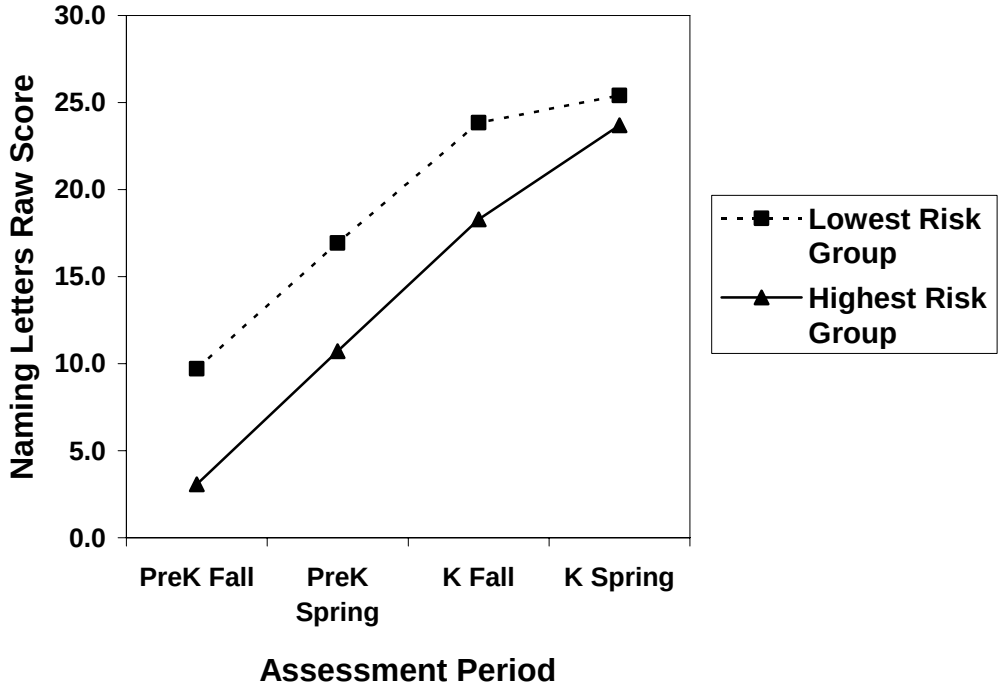


Figure 19. Growth in Math Skills (WJ-III Applied Problems) by Cumulative Risk

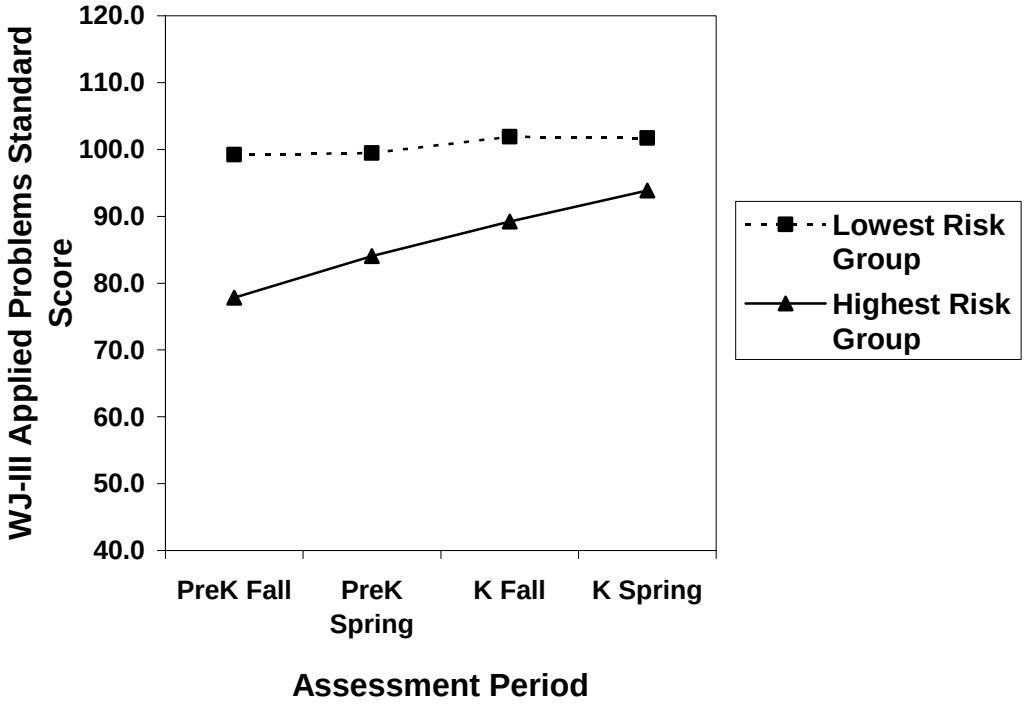


Figure 20. Growth in General Social Knowledge (Social Awareness Task) by Cumulative Risk

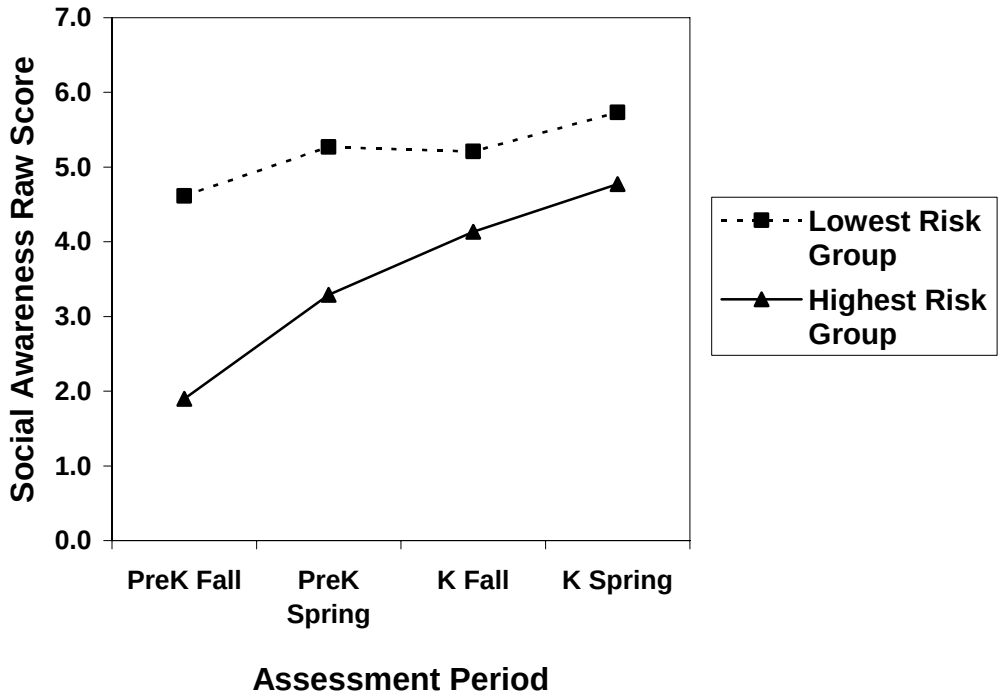


Figure 21. Growth in Color Knowledge (Color Naming Task) by Cumulative Risk

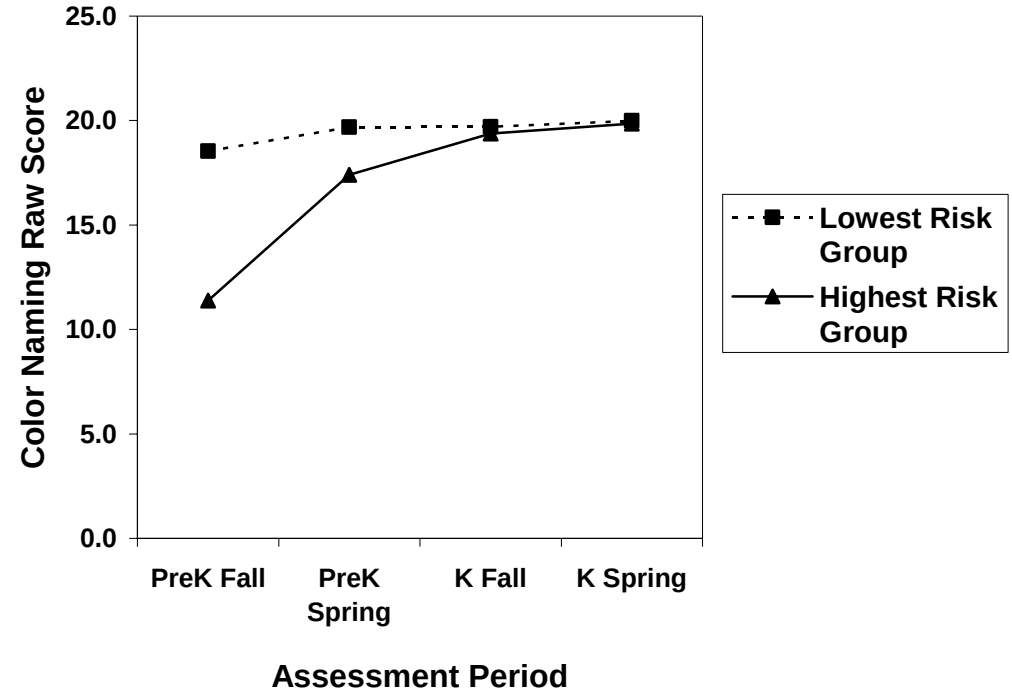
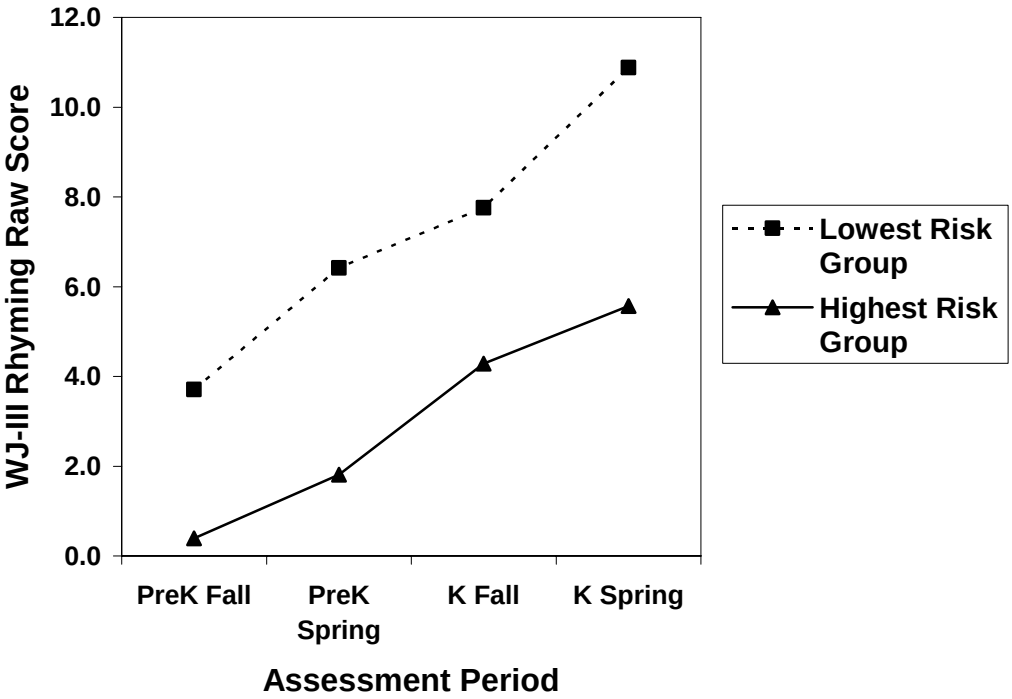


Figure 22. Growth in Phonological Awareness Skills (WJ-III Rhyming) by Cumulative Risk

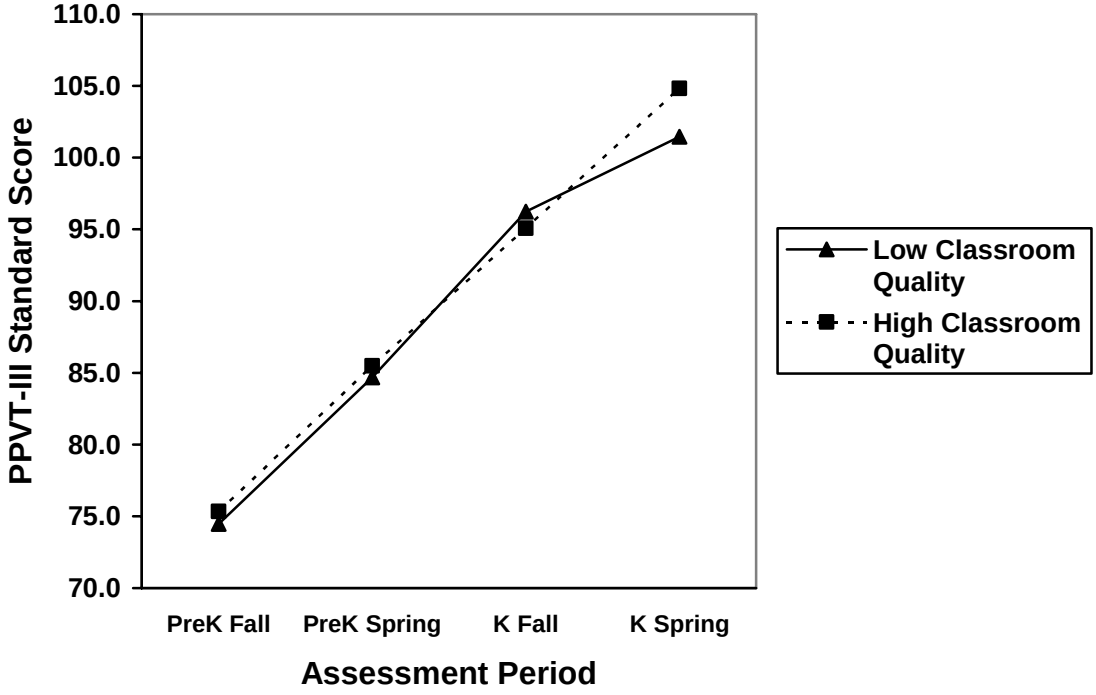


Do children in classrooms with higher quality practices in pre-k or kindergarten show greater growth in developmental skills?

We examined whether higher quality classroom practices in either pre-k or kindergarten (as measured by the ECERS-R) were associated with greater gains on the child outcome measures, after adjusting for individual children's levels of risk (risk factor status, service priority status, and English proficiency), gender, and age. (See next section of this report for further description of classroom quality in pre-k and kindergarten.) There were no differences in children's developmental progress over the two years on the basis of the quality of practices in their pre-k classrooms, suggesting that children benefited similarly from the More at Four Program through the end of kindergarten, regardless of the particular classroom they attended. This finding is not surprising, given the overall high quality of practices in the pre-k classes, most of which had average scores in the highest quality range. In contrast, children in higher quality kindergarten classrooms showed greater growth over the kindergarten year on one outcome measure, receptive language skills [$F(1, 174)=5.61$, $p<.02$], as seen in Figure 23. No differences on the basis of classroom quality in either year were found for the remaining measures.

Analytic Strategy: These analyses included a subset of the sample, since kindergarten classroom quality was only available for 185 children in 97 classrooms. For each outcome measure, we conducted separate repeated measures analyses using general linear models, with ECERS-R total child items score as the independent variable. One set of analyses tested the effects of pre-k quality on children's outcomes over the two-year period and a second set of analyses tested the effects of kindergarten quality over the kindergarten year. The analyses included children's gender and age at each assessment as covariates. The analyses also adjusted for children's risk status (risk factor level, service priority level, and English proficiency level) and classroom quality in pre-k (for the test of kindergarten effects) or kindergarten (for the test of pre-k effects), and tested the interactions of the quality variable of interest with time to examine whether there were any moderating effects on the amount of growth.

Figure 23. Growth in Receptive Language Skills (PPVT-III) for Children with Low vs. High Kindergarten Classroom Quality (ECERS-R)



Are there other factors accounting for children's growth, such as pre-k program dosage or the timing of assessments?

We looked at the possible associations of three factors with children's growth from pre-k to kindergarten to examine the extent to which children's outcomes were likely related to their participation in the More at Four Program. First of all, we examined whether there were substantial enough differences in children's "dosage" of the pre-k program (i.e., amount of attendance) to affect the level of growth. Second, we examined whether there were significant differences in children's growth related to the timing of assessments at each of the four periods to insure that differences were not due to variations among children in the length of time between assessments. Third, we specifically examined the issue of "summer growth" to investigate the extent to which children's gains in skills were occurring in conjunction with pre-k or kindergarten program participation.

Program Dosage

The first set of analyses addressed the effects of the dosage of the pre-k program received by each child on the amount of growth on the outcomes measures. We examined whether the amount of children's pre-k program attendance was associated with growth during pre-k and continuing into kindergarten, to determine whether children who experienced a greater dosage of the More at Four Program derived more benefit than those who experienced less.

The average days of More at Four attendance for children in our sample was 155.6 (SD=17.1), with a range from 69-195.

We first examined whether there were any associations between pre-k program dosage and children's scores or gains on the outcome measures. If significant results were obtained, we then examined whether these effects persisted after adjusting for other child characteristics (total risk, service priority status, English proficiency level, gender, and age at assessment) related to outcomes. In general, there were some positive effects of program dosage on children's level of performance on the outcome measures, but not the amount of gain, across the different outcome areas. However, none of these effects of program dosage remained after adjusting for other child characteristics. For language/literacy skills, greater program dosage was related to higher scores, but not greater gains, on the Rhyming [$F(1,506)=6.65$, $p<.05$] and Literacy concepts tasks [$F(1,509)=4.36$, $p<.05$], but these effects were not significant after adjusting for child characteristics. There were no effects of program dosage on receptive language ability or on either measure of math skills (applied problems or counting). For behavioral skills, greater program dosage was related to higher scores on social skills [$F(1,512)=5.84$, $p<.05$] prior to adjusting for other child characteristics, but was not related to problem behaviors scores. In sum, these findings suggest that children who received a greater dosage of the More at Four program (i.e., attended more days) had more advanced social skills and pre-reading skills (literacy concepts and phonological awareness) throughout the pre-k year and the kindergarten year, both at entry into the pre-k program and over time, but did not differ in the amount of gain over time. However, these associations were not obtained after taking into account other child characteristics related to children's outcomes, suggesting that program dosage was not having an independent effect from differences in children's risk levels and demographic characteristics. This lack of an independent dosage effect may also be related to the generally high rates of program attendance for most children. The average attendance was 156 days, or 87% of the typical 180 day school year, so most children received a relatively high dosage of the More at Four program. While there was some variation in attendance within our sample, it may not have been sufficient to result in independent effects on pre-k and kindergarten outcomes.

Analytic Strategy: Separate repeated measures analyses using a general linear models approach were conducted for each outcome measure, with scores at all four time points (fall pre-k, spring pre-k, fall kindergarten, spring kindergarten) as the dependent variables to examine changes in overall growth from the beginning of pre-k to the end of kindergarten. The first set of analyses included total pre-k attendance and the interaction between pre-k attendance and time as the predictors, to test whether there were any associations between program dosage and children's level of performance or amount of gain on the outcome measures. If significant differences were found, the second set of analyses included child characteristics (total risk, service priority status, English proficiency level, gender, and age at assessment) and their interactions with time as covariates to test whether the effects of program dosage still remained after adjusting for other factors related to children's level of performance and/or gains over time on the outcome measures.

Timing of Assessments

The second set of analyses addressed the issue of the effects of the time between assessment points on the amount of children's growth on the outcomes measures. While we did attempt to assess children as early as possible in the fall and as late as possible in the spring each year, and to maintain consistent intervals between fall and spring assessments across children, there was variation based on schools' schedules and children's absences. Therefore, we examined whether variations in the timing of assessments for individual children were substantial enough to have a measurable impact on the amount of growth on the outcome measures, after adjusting for child characteristics (English proficiency, risk factor total, service priority status, and gender) and pre-k classroom quality (as measured by the ECERS-R). We looked at the time between assessments for three different periods: 1) Fall Pre-k to Spring Pre-k (pre-k program effects), 2) Spring Pre-k to Fall Kindergarten (interim period), and 3) Fall Kindergarten to Spring Kindergarten (kindergarten program effects). For the pre-k period, we also included the amount of time elapsed from when the child entered the pre-k program to the first assessment, to examine unmeasured effects of the pre-k program (i.e., effects that occurred prior to the baseline assessment).

In general, there were few effects of time between assessments after adjusting for child and classroom characteristics, suggesting that the previous findings of differences in outcomes on the basis of child or classroom characteristics were not due to systematic differences in the timing of assessments. The length of time from the Fall baseline to the Spring end-of-year assessments in Pre-k was not associated with differences in the amount of growth on any of the outcome measures, indicating that the variations among children in the measured amount of time in the pre-k program were not substantial enough to affect the results. Similarly, there were no effects of the length of time between Spring Pre-k and Fall Kindergarten assessments on the amount of children's growth, suggesting that there were no differential effects of the length of this interim period. There was one effect of time between the Fall Kindergarten and Spring Kindergarten assessments, indicating that children with a longer measured time in kindergarten (i.e., greater time between the Fall and Spring assessments) showed greater gains on the Naming Letters task [ß (se) = .04 (.02), $p<.05$], although most children reached the ceiling on this measure by the end of kindergarten.

There were a few significant associations related to variations in the unmeasured effects of the pre-k program, indicating some decreases in the amount of growth on outcome measures for children with greater pre-k attendance prior to their first assessment. Gains during pre-k decreased as the time prior to baseline increased for the applied problems measure of math skills [ß (se)=-.14 (.05), $p<.05$] and for social skills [ß (se)=-.12 (.05), $p<.05$]. Similarly, fewer decreases in problem behaviors were found for children with shorter measured times in the pre-k program [ß (se)=.09 (.04), $p<.05$]. These findings suggest that the previous results related to children's gains over time, while still significant, may have slightly underestimated the amount of growth attributable to participation in the More at Four Program in these areas for children with greater program attendance prior to baseline.

Analytic Strategy: Three separate regression analyses were conducted for each outcome measure to examine whether variations in the time between assessments were associated with differences in the amount of gain on the outcome measures, controlling for child characteristics (English proficiency, risk factor total, service priority status, and gender) and

pre-k classroom quality (ECERS-R total child items score). Three different time periods were examined: 1) Fall Pre-k to Spring Pre-k to measure the effects of variations in the amount of time in the pre-k program on growth during pre-k, 2) Spring Pre-k to Fall Kindergarten to measure the effects of variations in the amount of time in the interim period between the end of pre-k and beginning of kindergarten assessments, and 3) Fall Kindergarten to Spring Kindergarten to measure the effects of variations in the amount of time in the kindergarten program on growth during kindergarten. In addition, for the first analysis, the amount of time children attended the pre-k program prior to the first assessment was included, to adjust for unmeasured effects of the pre-k program prior to the baseline measurement.

Summer Effects

We compared the amount of gains children made during the pre-k program year, the kindergarten program year, and the summer period between pre-k and kindergarten. Issues of interest were the extent to which growth occurred during the program year (pre-k or kindergarten) vs. over the summer as well as whether children exhibited an often-reported pattern of "summer loss" of skills following their participation in More at Four. To more fully capture the amount of growth during the pre-k and kindergarten programs, we extrapolated individual growth curves for children to the beginning and end of each program year, to represent the total change during the pre-k and kindergarten programs. The remaining change was then attributed to the summer period. We also adjusted for other factors associated with children's gains on the outcome measures, including child characteristics (risk total, service priority status, English proficiency, gender) and pre-k program quality (as measured by the ECERS-R).

As seen in Table 4, in general, children exhibited greater growth during the pre-k and/or kindergarten years than over the summer period across all outcome domains. Significantly greater gains were found during both pre-k and kindergarten, compared to summer, for language and literacy measures (rhyming, literacy concepts), math skills (applied problems), behavioral skills (social skills), and general knowledge (social awareness). For literacy concepts, gains were greater in kindergarten than pre-k as well. Greater gains were found during pre-k, compared to both summer and kindergarten, for some aspects of language/literacy skills (naming letters) and general knowledge (color naming). Both of these are skills that children generally mastered by the end of pre-k, and therefore had little room for growth in kindergarten. Greater gains were found for pre-k compared to summer only for one aspect of math skills (counting). Differences were found only between pre-k and kindergarten for receptive language ability, which may reflect the effects of children's initial exposure to a formalized educational program in pre-k, with less growth expected from subsequent exposure in kindergarten. Similarly to other findings, there were no differences in the area of problem behaviors, which changed very little over time (and were near the expected mean for this measure). It is important to note that although there tended to be less gain over the summer, children still showed some growth on most measures. The one clear exception was social skills, which exhibited a drop from the end of pre-k to the beginning of kindergarten; however, these scores are based on teacher ratings and this drop may reflect the increased expectations of kindergarten teachers compared to pre-k teachers in this domain. Contrary to some beliefs, we did not find evidence of a summer loss of skills. Rather, these findings suggest that, for most areas, the growth trajectory children established in the pre-k

year continued over the summer period, albeit to a lesser extent, and was re-established in kindergarten.

Analytic Strategy: Individual growth curves for pre-k and kindergarten were estimated for each child based on fall and spring scores, and were extrapolated to the beginning and end of each school year to more fully capture growth during the program year. The remaining change was attributed to the summer period. For the pre-k year, we extrapolated each child's growth based on their first and last day of attendance for the More at Four Program. Because individual attendance data were not available for the kindergarten year, we used a common start date (August 25) and a common end date (May 25), based on the typical public school calendar that year. Separate repeated measures analyses using a general linear models approach were conducted for each outcome using the change scores for pre-k (extrapolated spring pre-k score minus extrapolated fall pre-k score), kindergarten (extrapolated spring kindergarten score minus extrapolated fall kindergarten score), and summer (extrapolated fall kindergarten score minus extrapolated spring pre-k score). In addition, these analyses adjusted for child characteristics (risk total, service priority status, English proficiency, gender) and pre-k program quality (ECERS-R total child items score).

Table 4. Extrapolated Change Scores on Outcome Measures for Pre-k, Kindergarten, and Summer Periods

Domain	Outcome	**Pre-k** (n=380-427) **Mean** (SD)	**Kindergarten** (n=276-327) **Mean** (SD)	**Summer** (n=259-312) **Mean** (SD)	**Significant Difference**[1]
Language and literacy	PPVT-III receptive language[2]	5.6 (13.6)	3.1 (16.6)	3.8 (13.7)	P>K
	WJ-III Rhyming[3]	3.5 (4.4)	3.5 (5.7)	1.3 (4.6)	P>S K>S
	Story and Print Concepts[4]	2.6 (2.9)	3.1 (3.6)	1.4 (3.0)	P>S K>P,S
	Naming Letters[5]	11.5 (9.9)	5.2 (8.5)	4.7 (7.4)	P>K,S
Math	WJ-III Applied Problems[2]	3.1 (15.4)	5.3 (16.6)	1.2 (13.0)	P>S K>S
	Counting Task[6]	9.9 (13.2)	8.8 (18.6)	7.2 (14.8)	P>S
Classroom behavior	SSRS Social Skills[2]	8.8 (17.1)	9.0 (19.4)	-11.6 (19.2)	P>S K>S
	SSRS Problem Behaviors[2]	1.2 (13.9)	-0.5 (16.4)	1.1 (16.7)	NS
General knowledge	Social Awareness[7]	1.1 (2.0)	0.9 (1.8)	0.0 (1.5)	P>S K>S
	Color Naming[8]	3.2 (5.6)	0.4 (2.4)	0.4 (2.4)	P>K,S

[1] Note: P=Pre-k change; K=Kindergarten change; S=Summer change.
[2] Indicates standardized, norm-referenced measure with mean=100, SD=15.
[3] Possible range =0-17
[4] Possible range =0-14
[5] Possible range =0-26
[6] Possible range =1-40
[7] Possible range =0-6
[8] Possible range =0-20

WHAT WAS THE QUALITY OF THE PRE-K AND KINDERGARTEN PROGRAMS ATTENDED BY MORE AT FOUR CHILDREN?

Information was gathered in order to examine the quality of practices in children's preschool More at Four classrooms and kindergarten classrooms. In 2003-2004, observations were conducted in a random sample of 99 More at Four classrooms, including 57 of the 58 classrooms in which child outcomes data were also gathered. In 2004-2005, observations were conducted in a random sample of 97 of the 248 kindergarten classrooms attended by children for whom we had child outcomes data. (See Appendix A for more information about the classroom quality data collection.)

The observational measure used, the Early Childhood Environment Rating Scale-Revised[13] (ECERS-R), examined the developmental appropriateness of classroom practices, including the activities and materials provided, the interactions among teachers and children, the physical environment, and the daily organization of the program, with standard modifications for the kindergarten classrooms. Six of the seven subscales were used in the current study (Space and furnishings, Personal care routines, Language-reasoning, Activities, Interaction, and Program Structure). The items on the Parents and Staff subscale were deemed less relevant to kindergarten classrooms and therefore were not measured, with the exception of one item related to staff cooperation. Scores on this measure are often categorized into three groups representing good (5.0-7.0), medium (3.0-4.9), and poor (1.0-2.9) quality practices. Scores in the highest range, commonly described as "developmentally appropriate practices," are considered to meet the standards of best practice for promoting children's development. Scores in the medium quality range indicate classrooms that are likely to meet children's basic care needs, but may not always utilize practices that promote their development. Scores in the poor quality range indicate practices which are not likely to meet children's basic care needs and offer few opportunities for promoting children's development. In addition, we gathered information on the use of "specials" in kindergarten, including types and amount of time provided, in order to more fully capture variations in kindergarten classroom practices.

What was the overall quality of practices in the classrooms attended by More at Four children in pre-k and kindergarten?

The quality of classroom practices tended to be substantially higher in pre-k than in kindergarten. Average scores on the ECERS-R for the preschool More at Four classrooms and the kindergarten classrooms are presented in Table 5. In pre-k, the average total score was in the highest quality range, with a mean total score of 5.3 (SD=0.7). This average score is higher than what is often found in samples of preschool programs, where the average score is usually around the middle of the medium range. In kindergarten, the average total score was substantially lower, 3.2 (SD=0.8), at the lower end of the medium level.

Table 5. Comparison of Pre-k and Kindergarten Quality of Classroom Practices (ECERS-R Mean Item Scores)

Subscales and Items	Item Description	2003-2004 Pre-k Classrooms (n=99)			2004-2005 Kindergarten Classrooms (n=97)			t[1]
		Mean	SD	Range	Mean	SD	Range	
Total Child Items Score	**(items 1-37)**	**5.3**	**0.7**	**3.0-6.6**	**3.2**	**0.8**	**1.5-4.7**	**20.9***[2]
Space and Furnishings Subscale	**(items 1-8)**	**5.0**	**0.9**	**3.0-6.8**	**3.5**	**0.8**	**1.4-6.4**	**13.2***
1	Indoor space	5.0	1.9	1-7	4.6	2.2	1-7	--
2	Furniture for routine care, play, and learning	6.4	1.2	2-7	6.1	1.5	1-7	--
3	Furnishings for relaxation and comfort	5.5	1.6	3-7	2.8	1.3	1-7	--
4	Room arrangement for play	5.6	1.7	1-7	4.3	1.7	1-7	--
5	Space for privacy	5.2	1.9	2-7	3.5	1.0	1-7	--
6	Child-related display	4.9	1.5	3-7	3.1	0.9	2-6	--
7	Space for gross motor play	3.5	2.0	1-7	1.8	1.1	1-6	--
8	Gross motor equipment	3.9	2.3	1-7	1.8	0.7	1-7	--

[1] *$\underline{p}$ < .05, **$\underline{p}$ < .01, ***$\underline{p}$ <.001
[2] Degrees of freedom = 194

Table 5. Comparison of Pre-k and Kindergarten Quality of Classroom Practices (ECERS-R Mean Item Scores) ***(continued)***

Subscales and Items	Item Description	2003-2004 Pre-k Classrooms (n=99)			2004-2005 Kindergarten Classrooms (n=97[3])			t[4]
		Mean	SD	Range	Mean	SD	Range	
Personal Care Routines Subscale	**(items 9-14)**	**4.9**	**1.1**	**2.3-7.0**	**2.4**	**1.0**	**1.0-5.0**	**17.0*** [5]
9	Greeting/ departing	6.6	0.9	4-7	4.0	2.3	1-7	--
10	Meals/snacks	4.0	2.1	1-7	1.3	1.0	1-7	--
11	Nap/rest	5.0	2.0	2-7	1.5	1.1	1-4	--
12	Toileting/ diapering	5.1	2.5	1-7	3.2	2.7	1-7	--
13	Health practices	5.2	1.9	1-7	2.1	1.2	1-6	--
14	Safety practices	3.9	2.5	1-7	2.0	1.7	1-7	--
Language-Reasoning Subscale	**(items 15-18)**	**5.8**	**0.9**	**3.3-7.0**	**4.1**	**1.2**	**1.5-6.3**	**10.9*** [6]
15	Books and pictures	5.5	1.5	2-7	3.0	1.3	1-7	--
16	Encouraging children to communicate	6.6	0.8	4-7	4.3	2.3	1-7	--
17	Using language to develop reasoning skills	4.9	1.5	2-7	4.5	1.4	1-7	--
18	Informal use of language	5.9	1.4	2-7	4.5	2.1	1-7	--

[3] For item 9, n=96; for item 11, n=61.
[4] *p < .05, **p < .01, ***p <.001
[5] Degrees of freedom = 194
[6] Degrees of freedom = 174

Table 5. Comparison of Pre-k and Kindergarten Quality of Classroom Practices (ECERS-R Mean Item Scores) ***(continued)***

Subscales and Items	Item Description	2003-2004 Pre-k Classrooms (n=99[7])			2004-2005 Kindergarten Classrooms (n=97)			t[8]
		Mean	SD	Range	Mean	SD	Range	
Activities Subscale	**(items 19-28)**	**4.9**	**0.8**	**2.8-6.6**	**2.4**	**0.7**	**1.1-4.4**	**22.3*** **
19	Fine motor	5.6	1.5	3-7	3.1	1.6	1-7	--
20	Art	5.0	1.7	1-7	2.8	1.0	1-7	--
21	Music/ movement	4.3	1.6	2-7	2.1	1.0	1-7	--
22	Blocks	4.5	1.1	3-7	1.8	1.0	1-4	--
23	Sand/water	4.8	1.4	1-7	2.1	1.3	1-6	--
24	Dramatic play	4.9	1.4	2-7	2.0	1.0	1-4	--
25	Nature/science	4.5	1.7	2-7	1.7	1.0	1-4	--
26	Math/number	4.9	1.5	1-7	3.0	1.2	1-4	--
27	Use of TV, video, and/or computers	5.2	2.0	1-7	2.7	2.3	1-7	--
28	Promoting acceptance of diversity	5.1	1.4	2-7	3.0	0.7	1-5	--

[7] For item 27, n=90.
[8] *$\underline{p}$ < .05, **$\underline{p}$ < .01, ***$\underline{p}$ <.001

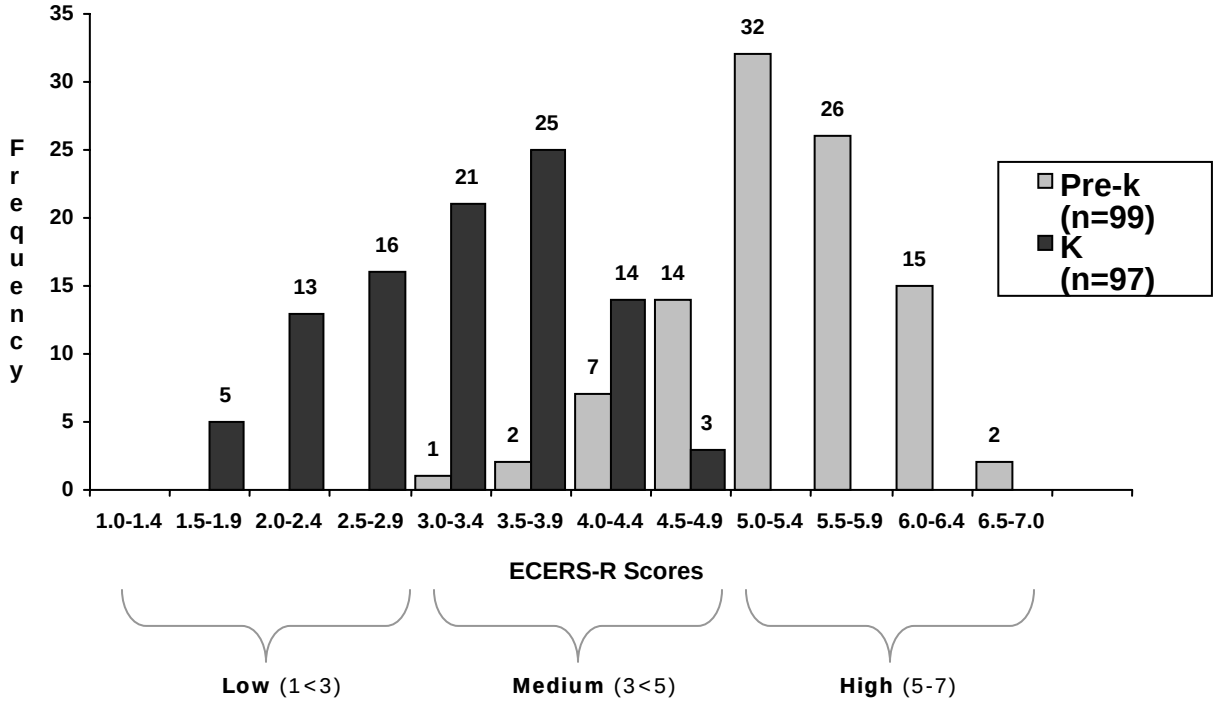
Table 5. Comparison of Pre-k and Kindergarten Quality of Classroom Practices (ECERS-R Mean Item Scores) *(continued)*

Subscales and Items	Item Description	2003-2004 Pre-k Classrooms (n=99[9])			2004-2005 Kindergarten Classrooms (n=97[10])			t[11]
		Mean	SD	Range	Mean	SD	Range	
Interaction Subscale	**(items 29-33)**	**6.2**	**1.0**	**1.4-7.0**	**4.7**	**1.8**	**1.0-7.0**	**7.2***[12]
29	Supervision of gross motor activities	5.1	1.7	1-7	3.3	1.9	1-7	--
30	General supervision of children	6.3	1.4	1-7	5.2	2.1	1-7	--
31	Discipline	6.2	1.2	1-7	4.6	2.5	1-7	--
32	Staff-child interactions	6.6	1.2	1-7	5.1	2.5	1-7	--
33	Interactions among children	6.6	1.0	1-7	5.2	2.5	1-7	--
Program Structure Subscale	**(items 34-37)**	**6.2**	**0.9**	**3.8-7.0**	**3.1**	**0.9**	**1.0-4.8**	**24.6***[13]
34	Schedule	6.0	1.6	2-7	1.7	0.6	1-4	--
35	Free play	6.3	1.3	1-7	2.2	1.3	1-4	--
36	Group time	6.3	1.2	3-7	3.2	2.0	1-7	--
37	Provisions for children with disabilities	6.1	1.2	1-7	5.6	1.2	1-7	--
Parents and Staff Subscale[14] Item 41	Staff interaction and cooperation	6.6	1.1	1-7	6.0	1.7	1-7	--

[9] For item 29, n=98, for item 37, n=70.
[10] For item 29, n=86; for item 33, n=96; for item 37, n=80; for item 41, n=90.
[11] *p < .05, **p < .01, ***p <.001
[12] Degrees of freedom = 150
[13] Degrees of freedom = 194
[14] Only one item from this subscale (item 41) was administered in kindergarten classrooms.

As seen in Figure 24, total scores were in the highest quality range for 76% (75) of the More at Four classrooms, and in the medium quality range for the remaining 24% (24). It is notable that none of the More at Four classrooms observed had total scores in the poor quality range. In contrast, none of the kindergarten classrooms had average scores in the high quality range, with 65% (63) scoring in the medium quality range and the remaining 35% (34) scoring in the poor quality range.

Figure 24. Pre-k and Kindergarten Distribution of Global Classroom Quality Scores (ECERS-R Total Child Items)



What were specific areas of strength and weakness in classroom practices in pre-k and kindergarten?

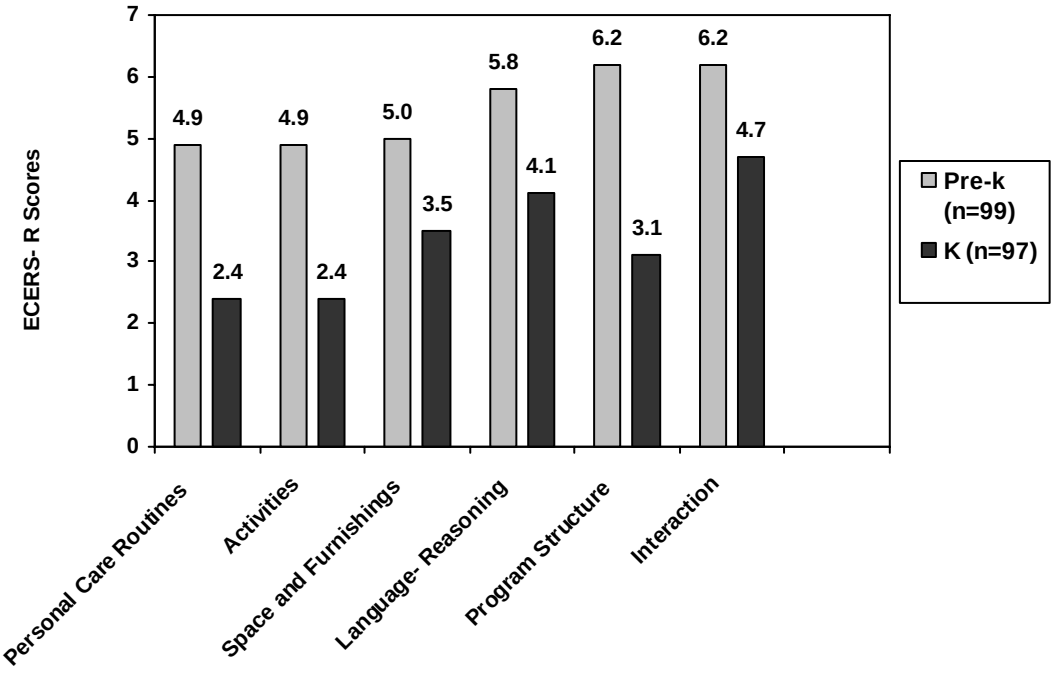
As seen in Table 5 and Figure 25, the pattern of scores by subscales was similar in the pre-k and kindergarten classes, although scores were higher in the pre-k classes. In the More at Four classrooms, the average subscale scores were in the high quality range (at or above 5.0) for four of the six subscales (Space and furnishings; Language and reasoning; Interaction; Program structure), and were above 4.5[14] for all of the subscales, including the remaining two (Personal care routines and Activities). In contrast, in the kindergarten classrooms, the average subscale scores were in the medium quality range for the same four subscales (Space and furnishings; Language and reasoning; Interaction; Program structure) and were in the poor quality range for the remaining two (Personal care routines and Activities).

At the item level, the average scores in the More at Four classrooms were in the high quality range for approximately two-thirds (68%, 25) of the items and in the medium quality range for the remaining one-third (32%, 12). In the kindergarten classrooms, only 14% (5) of the items were in the high quality range, 43% (16) were in the medium quality range, and 43% (16) were in the poor quality range.

Comparisons of areas of strength and weakness across the two settings provide some evidence of the continuity or discontinuity of experiences as children make the transition from preschool to school. There are a few areas of strength common to both settings, including basic furniture for routine care, play and learning; general supervision of children; interactions, both staff-child and among peers; and provisions for children with disabilities. In the More at Four classrooms, the majority of aspects of the classroom were rated in the high quality range, suggesting that this program provides a developmentally appropriate experience for children in most areas.

There were some areas of weakness common to both settings, particularly space and equipment for gross motor activities and safety practices (as well as gross motor supervision in kindergarten), both of which are important areas to consider in terms of injury prevention. A number of other areas in kindergarten classrooms scored low, including most items related to space and furnishings other than the basic furniture. Several aspects of personal care also scored low, including snack/meal times, nap/rest times, and health and safety practices, suggesting that less attention may be given to children's individual routine care needs in kindergarten. A number of items related to program structure, including schedule, free play, and group time, were also low-scoring in kindergarten classes, likely reflecting the limited opportunities children have for making choices and individualizing activities in these settings. Almost all aspects of activities also scored low in kindergarten settings, with two of the three items scoring slightly higher (fine motor activities and math activities) related to academic areas that are more likely to be emphasized in kindergarten, and the remaining item (diversity) perhaps reflecting a broader emphasis of public schools. The items related to language and reasoning activities tended to score somewhat higher in the kindergarten settings, but still in the medium range, and given that this a key area for the development of a range of academic skills, may merit further attention.

Figure 25. Pre-k and Kindergarten Global Classroom Quality Mean Subscale Scores (ECERS-R)



Were there significant differences in the quality of pre-k and kindergarten practices?

T-tests were conducted to examine the differences in overall quality and subscale area scores between pre-k and kindergarten settings. As seen in Table 5, the total ECERS-R score and all subscale scores were significantly higher in the More at Four classrooms than in the kindergarten classrooms. These findings suggest that, for children attending the More at Four Program, their experiences in pre-k are likely to be more developmentally appropriate than subsequent experiences in kindergarten.

What factors were associated with better quality practices in pre-k and kindergarten?

Total class size, one factor that could be measured in common across the pre-k and kindergarten settings and that has been found to relate to classroom quality, was examined to see whether it was associated with the quality of classroom practices in the present study (as measured by the total child items score on the ECERS-R). Total class size was significantly related to classroom quality in kindergarten [$F(1, 91)=7.01$, $p<.01$], but not in pre-k, with smaller kindergarten classrooms evidencing better quality practices than larger classrooms. As expected, the average class size as well as the range were larger in kindergarten (mean=19.7, SD=2.7, range=13-27) than in pre-k (mean=16.4, SD=2.3, range=9-18).

Analytic Strategy: Separate analyses were conducted for pre-k and kindergarten classrooms using a general linear models approach. The total child items score on the ECERS-R was used as the dependent measure. The predictor, class size was entered as a continuous variable. These analyses also adjusted for teacher ece qualifications (whether or not the teacher had a B-K or preschool add-on license or provisional license), entered as a 2-level categorical covariate (0=no ece license, 1=ece license).

What are the associations with use of specials in kindergarten?

Another important difference between pre-k and kindergarten classrooms is the common use of "specials" in kindergartens, where children receive instruction in different topics such as art or music or physical education from teachers other than the regular classroom teacher who specialize in the particular area. To further explore the differences in the quality of kindergarten classrooms, we gathered information on the use of specials in the classrooms we visited, and examined the associations between the time spent in different types of specials and related scores on the ECERS-R. We expected that there might be fewer materials and instructional time within the classroom for areas covered in specials, and conversely, that there might be more provisions within the classrooms for specific areas with less (or no) specials time offered. Since the ECERS-R scores were primarily based on activities and materials within the regular classroom as opposed to those provided during specials, we examined whether greater use of specials was associated with lower ECERS-R scores on related items.

Information about the use of specials was obtained by reviewing weekly class schedules provided by the lead teachers, including information about all specials provided to children, even those provided less often than weekly. Class schedule information was available for 95% (92/97) of the kindergarten classes in the sample. The class schedules revealed that all of the kindergarten classes in our sample offered at least one special per week, up to as many as seven per week (see Table 6). The average number of specials per class was 4.8 (SD = 1.1), with most classes (92%) providing at least four or more types of specials. On average, classes in our sample provided almost 3 hours of specials per week (172 minutes), although the totals ranged from ½-hour per week to nearly 5½-hours per week (see Table 7). The majority of classrooms provided specials in the areas of Physical Education (91%), Library (86%), Music (80%), Computers (74%), and Art (65%). Less frequently reported specials included Guidance (39%), Spanish (10%), and Science (6%). When specials were provided, an average of about ½-hour per week was spent in each special. The one exception was Physical Education, which was provided for the largest amount of time, an average of 44 minutes per week.

These findings suggest that children in our kindergarten sample were receiving a moderate amount of specials instruction outside of the classroom on a regular basis, providing them with additional opportunities to develop skills in such areas as gross motor development (e.g., physical education), language and literacy (e.g., library), and creative activities (e.g., music and art). Although we do not have any information about the quality of these activities, it is possible that the kindergarten ECERS-R scores may have systematically underestimated the areas related to the specials. Since ECERS-R scores were primarily based on what occurred in the regular classroom and did not take into account the activities

that occurred during specials, we expected that scores might be relatively higher in classrooms with less use of specials and relatively lower in classrooms with greater use of specials. Therefore, we examined the correlations between the amount of time spent in various specials and related items on the ECERS-R. In all cases, we examined the associations of the Schedule, Free play, and Group time ECERS-R items with the time spent in each type of special as well as the total amount of time spent in specials, with the idea that any kind of specials time could impact these items. In addition, we also examined the correlations for specific items on the ECERS-R that were relevant to the particular type of special.

There were no significant associations between ECERS-R scores on the Schedule, Free play, or Group time items and the amount of time spent in specials overall or in the various types of specials. Similarly, there were no associations between specific ECERS-R item scores (listed in parentheses) and specials time for Library (Books/pictures), Music (Music), Computers (TV/computers), Art (Art), Guidance (Diversity, Discipline, Staff-child interactions, Interactions among children), Spanish (Books/pictures, Encouraging communication, Diversity), or Science (Nature/science). The only significant correlations were found between the specials time spent in Physical Education and the specific ECERS-R items for Gross motor space (r=.39, p<.001), Gross motor equipment (r=.28, p<.05), and Gross motor supervision (r=.29, p<.05), indicating that ECERS-R scores were higher in these areas for classrooms providing more Physical Education specials time. In contrast to the other items, the gross motor items on the ECERS-R are more strongly based on the general provisions at the school, as opposed to the provisions within the classroom. This finding indicates that in cases where more specialized Physical Education instruction is provided, the schools are likely to have better provisions in terms of space, equipment, and supervision for these activities. For the remaining types of specials, however, the amount of instructional time spent in these areas did not account for any systematic differences in ECERS-R scores.

Table 6. Total Number of Specials Provided per Classroom
n=92[1]

Total Number of Specials	Number of Classes	% of Classes
1	1	1.1%
2	1	1.1%
3	5	5.4%
4	32	34.8%
5	30	32.6%
6	20	21.7%
7	3	3.3%

[1] Specials information was not available for 5 classes.

Table 7. Types of Specials and Amount of Time Provided per Week
n=92[1]

Type of Special	Classrooms Providing n (%)	Average Minutes/Week for Classrooms Providing Each Special		
		Mean	SD	Range
Physical Education	88 (90.7%)	44.3	25.1	13-150
Library/Media	83 (85.6%)	36.2	13.2	13-80
Music	77 (79.4%)	32.6	10.7	13-60
Computers	72 (74.2%)	37.5	15.4	13-90
Art	63 (65.0%)	33.8	14.2	7-90
Guidance	38 (39.2%)	26.1	16.0	8-90
Spanish	10 (10.3%)	37.8	11.8	25-60
Science	6 (6.2%)	27.6	11.2	13-40
Total/Class	---	171.6	57.5	30-325

[1] Specials information was not available for 5 classes.

Summary and Conclusions

The primary research questions addressed by this evaluation included:

- What were the longitudinal outcomes from pre-k through kindergarten for children who attended the More at Four Program?
- What factors were associated with better outcomes for children?
- What was the quality of the kindergarten programs attended by children in comparison to their pre-k experiences in More at Four?

In response to the first research question, these findings provide evidence that children who participated in the More at Four Program made substantial progress in language/literacy skills, math skills, social skills, and general knowledge from the beginning of pre-k through the end of kindergarten. These gains are especially notable on two standardized measures, receptive language and applied math skills, where children sustained a consistent pattern of growth over time. For these standardized measures, children's scores can be compared to the population mean (i.e., score of 100). In the case of receptive language, they made significant gains over this two-year period, moving from one standard deviation below the mean (mean score of 85) at entry into pre-k to slightly below the mean at the end of kindergarten (mean score of 96). For math skills, children progressed from approximately one-half a standard deviation below the mean at entry into pre-k (mean score of 93) to scoring at the population mean (mean score of 100) by the end of kindergarten. Children exhibited a somewhat different pattern for standardized behavioral measures (social skills and problem behaviors), which were based on teacher ratings each year. On social skills, children entered the pre-k program close to the population mean and made some gains each year, although the gains exhibited in pre-k were not maintained at entry into kindergarten. This decrease from the end of pre-k to the beginning of kindergarten may reflect differences in teachers' expectations across the two settings. In both cases, however, even though children began around the expected level for their age in the fall, teachers still perceived some gains over the course of the year. In terms of problem behaviors, children consistently scored just below the mean at each time period, suggesting that they were exhibiting an expected amount of problem behaviors for their age both in pre-k and kindergarten. For some measures (letter knowledge, color knowledge, and social awareness), most children were scoring at or near the ceiling by entry into or by the end of kindergarten, suggesting that they had mastered these basic academic skills, such as knowing the alphabet and color names, as well as social information such as their name and birth date. These results indicate that although these children entered the More at Four Program with language and academic skills substantially below the expected average for their age, they made significant developmental progress during their pre-k and kindergarten years. By the end of their first year in school, they were performing similarly to the expected average for their age across many domains. Given that the focus of the More at Four Program is on serving at-risk children who may not otherwise attend a pre-k program, these findings suggest that participation in this program may be beneficial for their school readiness and success.

Children made similar amounts of gain in most developmental skills in both the pre-K and kindergarten programs, suggesting that the progress they made during More at Four was

sustained through entry into school and that they continued to make similar gains throughout their kindergarten year. The one exception was receptive language skills, where children gained more during pre-k, with less growth during kindergarten. However, the amount of gain children made in receptive language skills in kindergarten was also influenced by the quality of their kindergarten classrooms, with children in higher quality kindergarten classrooms making greater progress than those in lower quality classrooms. In contrast, the quality of their pre-k classrooms was not associated with children's rate of growth, not surprisingly, given that the pre-k classrooms were generally of very high quality. Taken together, these findings suggest that greater continuity in the experiences from pre-k to kindergarten may be beneficial in at least one important skill area related to academic success (receptive language), although many children continued on the developmental trajectories established during the preschool year despite this discontinuity in classroom experiences as they made the transition to school.

Results related to the second research question indicated that there were some differences in the amount of growth children exhibited based on individual risk characteristics. In many cases, children at higher risk made greater gains over time in language/literacy skills than children at lower risk. This was especially true for children with lower levels of English proficiency, who gained more in receptive language (as did children at higher overall risk), math skills, and literacy concepts than children at higher levels of English proficiency. These findings suggest that participation in this early education program was especially beneficial to children at even greater risk for school failure. Not unexpectedly, the reverse was found for phonological awareness skills, where children at higher English proficiency levels gained more than those at lower levels. Phonological awareness is a higher level skill related to early reading ability which may require a more advanced level of English language knowledge than limited English proficient children had obtained even by the end of kindergarten.

In contrast, greater increases in teacher ratings of problem behaviors were found for higher-risk children (based on total risk), especially after they entered kindergarten, which may indicate evidence of greater difficulty with adaptation to the demands of the school setting and/or differences in the behavioral expectations of pre-k vs kindergarten teachers for this particular group of children. A similar pattern of increases in problem behaviors was found for children at lower levels of service priority, which may be associated with greater amounts of prior child care experience (especially lower quality child care), a finding similar to other studies.[10, 11] It is important to keep in mind, though, that these increases in problem behaviors were still fairly small, with scores slightly above the population mean at the end of kindergarten. Further, these increases in problem behaviors did not carry over into other skill areas associated with school success. It may be that the typically high quality experiences children had during the More at Four Program helped them adjust better to the academic demands of school, including adapting to the discontinuities as well as the continuities in experiences between pre-kindergarten and kindergarten.

To further understand the effects related to cumulative risk, we examined children's performance on the basis of four levels of overall risk. While children at all risk levels made progress over time from entry into the pre-k program through the end of kindergarten, children in the highest risk group made greater progress on several measures of

language/literacy skills, math skills, and general knowledge. For some measures, these children caught up to the other groups by the beginning of kindergarten (color knowledge) or by the end of kindergarten (letter knowledge, counting). However, for most measures of language/literacy skills (receptive language, rhyming, literacy concepts), math skills (applied problems), and general knowledge (social awareness), the scores for children in the highest risk group remained substantially lower through the end of kindergarten, despite their rate of progress. These findings suggest that many of the deficits in academic skills faced by children at the very greatest risk at entry into pre-k were not fully eradicated even by the end of kindergarten. For the highest-risk children, it may be that even more intensive services are required and/or that they may especially benefit from more than one year of such a program prior to kindergarten entry.

Another question of interest related to whether the actual level of program participation experienced by individual children affected their outcomes. Children who received a greater dosage of the pre-k program (i.e., higher attendance rates) did show some evidence of better pre-reading (rhyming and literacy concepts) and social skills over time, but these effects were not maintained when other child characteristics were taken into account. However, children generally received a high dosage of the pre-k program, attending for an average of 87% of a full school year (156 days), so the variations in dosage may not have been sufficient to result in differences in outcomes. We also examined whether children demonstrated greater growth during the program year (pre-k or kindergarten) compared to the summer as well as whether children exhibited an often-reported pattern of "summer loss" of skills following their participation in More at Four. In most cases, children exhibited greater growth during the pre-k and/or kindergarten years than over the summer period across all domains. However, contrary to some beliefs, we did not find evidence of a summer loss of skills. Rather, these findings suggest that, for most areas, the growth trajectory children established in the pre-k year continued over the summer period, albeit to a lesser extent, and was re-established in kindergarten.

In examining the third research question, we found that the scores on our classroom quality measure were substantially lower in kindergartens attended by More at Four children (with scores in the medium range, on average) compared to the More at Four pre-k classrooms they attended the previous year (with scores in the high quality range, on average). These lower scores in kindergarten may reflect differences in the structure, expectations for children, and general approach to learning between pre-k and kindergarten classrooms. There were some areas of strength common to both settings, including basic furniture for routine care, play and learning; general supervision of children; interactions, both staff-child and among peers; and provisions for children with disabilities. There were also some areas of weakness common to both settings, particularly space and equipment for gross motor activities and safety practices (as well as gross motor supervision in kindergarten), both of which are important areas to consider in terms of injury prevention. A number of other areas in kindergarten classrooms scored low; for example, low scores on several items related to routine care may suggest that less attention is given to children's individual needs in this area. Similarly, a number of items related to program structure were also low-scoring in kindergarten classes, likely reflecting the limited opportunities children have for making choices and individualizing activities in these settings. Almost all aspects of activities also scored low in kindergarten settings, perhaps reflecting a greater emphasis on academic areas in kindergarten. The items related to language and reasoning activities tended to score somewhat higher in the

kindergarten settings, but still in the medium range, and given that this a key area for the development of a range of academic skills, may merit further attention. In considering options for quality improvement, it is worth noting that one factor, smaller class size, was related to better quality in kindergarten.

One other key difference from pre-k classrooms is the use of specials in kindergarten, where children receive instruction by specialists in particular areas, such as PE or art. While we did not have information about the quality of instruction during specials, we did examine the amount of time spent and types of specials provided. Children spent an average of almost 3 hours per week in various types of specials, primarily physical education, library/media, music, computers, and art. We expected that when less time was spent in specials, there might be more materials and activities in those areas within the regular classroom, so that the ECERS-R scores might be relatively higher than for classrooms with more specials time. However, there were almost no associations between use of specials and classroom quality scores, suggesting that the the latter was not systematically underestimating children's opportunities in these areas. In contrast, the one significant finding was that classrooms with more specials time spent for physical education had better provisions in the areas of gross motor space, equipment, and supervision, not surprising given that these ECERS-R items are based largely on school-wide rather than classroom-specific provisions. While comparisons across the pre-k and kindergarten settings provide some evidence of the continuity or discontinuity of experiences as children make the transition to school, it is important to keep in mind that these differences in classroom practices were not related to differences in children's outcomes in most areas.

In sum, children who participated in the More at Four Program exhibited continued growth in key skill areas from the beginning of their pre-k year through the end of kindergarten, often performing at or close to the expected average for their age by the end of kindergarten. Given that these children were selected for More at Four based on their risk status and, as expected, were performing below average for their age at entry into the program, these gains are notable. Moreover, the program focused on serving children who otherwise would not have been likely to participate in a pre-k program, and therefore, may have been likely to enter school even farther behind their peers without such early education experiences. These findings are consistent with a number of other large-scale studies that have found that pre-k participation was associated with sustained gains in language/literacy, math, and social skills through kindergarten.[15, 16, 17] Similarly, a number of these studies have found greater gains for children at greater risk, especially in terms of language and literacy skills.[10, 11, 16, 17, 18] Many of these studies have also found similar effects related to higher rates of problem behaviors, although children were generally still scoring within normal ranges for their age.

Although the quality of the pre-k classrooms was significantly higher than the kindergarten classrooms, most children exhibited continued growth despite these discontinuities, suggesting that the high quality experiences provided in More at Four helped prepare them for school and enabled them to adapt to the school setting. Given other research evidence that the trajectories established in the early grades predict continued school success (or failure)[19], these findings suggest that the More at Four Program provides an early opportunity to help put children on the path toward school success.

Appendix A: Methods

Child Outcomes

A sample of children participating in the More at Four Program were followed from the beginning of their pre-kindergarten year through the end of kindergarten. Individual children's language and literacy skills, math skills, general knowledge, and social skills were measured near the beginning and end of pre-kindergarten and again near the beginning and end of kindergarten.

Participants

More at Four children were recruited from 58 randomly selected classrooms located across North Carolina. These classrooms were located in 56 More at Four sites from 34 counties/regions. Child assessment data were gathered on 514 children in Fall 2003. In Spring 2004, 467 (91%) of these children were re-assessed. Of the 47 children who were not re-assessed in Spring 2004, 44 had withdrawn from More at Four prior to the spring assessments, 2 had moved to another More at Four class and could not be assessed in their new class, and 1 was absent at the time of the assessment visits.

The kindergarten sample included children from 249 kindergarten classrooms and 137 schools, located in 38 public school districts, 2 charter schools not affiliated with public school districts, and 4 private schools, in a total of 36 counties. At the beginning of kindergarten (Fall 2004), child assessments were conducted with 348 (75%) of the children assessed the previous spring. The 119 children who were not included in the Fall 2004 assessments included 51 children we were unable to locate after attempting to contact parents and More at Four staff, 11 children from one school district that denied approval, 20 children located in 12 schools from whom we were unable to secure approval (most were from a district that did not give consent until just prior to the conclusion of fall data collection), 6 children whose parents denied consent to participate in the kindergarten portion of the study, 26 children whose parents did not return a consent form, 2 children whose parents did not return their consent forms until after the fall assessments were completed, 1 child whose teacher did not respond to scheduling calls, 1 child whose assessment was cancelled due to absence, and 1 for whom the reason was not documented. In Spring 2005, we reassessed 328 (94%) of the 348 children. All 20 children who were not re-assessed in Spring 2005 had moved and could not be assessed in their new school.

The total attrition rate over the two years of the study was 36%, with the bulk of the attrition occurring between the preschool and kindergarten years. The children remaining in the study by the end of kindergarten represented 55 of the 58 (95%) More at Four classes from Fall 2003, 53 of the 56 (95%) More at Four sites from Fall 2003, and 32 of the 34 (94%) More at Four counties/regions in which the Fall 2003 classes were located.

Sample Selection

Sample selection was conducted at the classroom level in the preschool year. Fifty-eight More at Four classrooms were randomly selected from all classrooms (n=599) in sites that had been in operation during the previous year (2002-03) and were serving children in the current year (2003-04) by early September. We attempted to recruit all More at Four children enrolled in the selected classrooms, with an overall consent rate of 85% (573/675). Children who were absent or had withdrawn from the program at the time of data collection were not assessed. Comparisons of assessed children to non-assessed More at Four children in the same classrooms (including both those who had parental consent but were not assessed and those who did not have parental consent) indicated that the two groups were similar in terms of average risk factor scores, service priority status, and demographic characteristics (the non-assessed group included 6% more boys, 9% more African-Americans, 6% fewer Caucasians, 5% fewer children with employed parents, and 4% higher average family income).

Child Characteristics

The average child age was 4.5 years (range = 4.0-5.0 years) at the time of the Fall 2003 assessments and 5.1 years (range 4.6–5.6 years) at the time of the Spring 2004 assessments. The average child age was 5.6 years (range 5.0-6.1 years) at the Fall 2004 assessments and 6.0 years (range 5.5-6.5 years) at the Spring 2005 assessments. At the time of study enrollment, half (50%) of the children were female and half were male; 37% were African-American, 36% Caucasian, 17% Latino, and 10% were from other ethnic/racial groups or combinations of groups.

Procedures

Two sources of child outcomes data were gathered: individual assessments of children's language and cognitive skills and teacher ratings of children's social skills and problem behaviors. Preschool data were gathered in Fall 2003 (9/20/03-11/7/03) and again in Spring 2004 (4/28/04-6/10/04). Kindergarten data were gathered in Fall 2004 (10/13/04-12/16/04) and in Spring 2005 (4/1/05-5/31/05). Child assessments were conducted on-site at each school or child care center, and lead teachers were asked to complete rating scales following the assessments. Data collectors were trained by the More at Four Evaluation Team and observed by a supervisor during training to ensure precise administration prior to gathering data in the field.

Measures

The child assessment battery consisted of eight measures focusing on language and literacy skills, pre-math skills, and general knowledge. Lead teachers also rated each child's social skills and problem behaviors in the classroom. The outcome areas measured were consistent with the recommendations of the National Education Goals Panel for defining school readiness. (See Table A1 for an overview of these measures.)

In addition, children were administered the PreLAS 2000[20], an individual assessment designed to measure young children's oral language proficiency in English, in order to adjust for children's English language proficiency in the analyses, as well as to examine English language proficiency as a moderator of program effects. Fluency scores, ranging from 1-5, based on the administration of three subscales (Simon Says, Art Show, and The Human

Body), were used to measure both receptive and expressive language ability. Separate measures of fluency at the beginning of preschool (Fall 2003) and beginning of kindergarten (Fall 2004) were included in the analyses.

Table A1. Child Outcome Measures

Domain	Measure	Skills Assessed
Language and literacy	Peabody Picture Vocabulary Test-III (PPVT-III)[21]	receptive vocabulary
	Woodcock Johnson-III Tests of Achievement (WJ-III)[22] Rhyming Subtest (subtest 21A, Sound Awareness test)	phonological awareness
	Naming Letters Task[23]	alphabet knowledge
	Story and Print Concepts Task[24]	early literacy skills including knowledge of books, story comprehension, and print awareness
Math	Woodcock Johnson-III Tests of Achievement[222] Applied Problems Test (Test 10)	ability to solve practical math problems including counting, simple addition and subtraction
	Counting Bears Task[25]	ability to count in one-to-one correspondence
General knowledge	Social Awareness Task[26]	knowledge of child's full name, age and birth date
	Color Bears Task[27]	knowledge of 10 basic colors
Classroom behavior	Social Skills Rating System (SSRS) Social Skills subscale[28]	social skills (e.g., "follows your directions")
	Social Skills Rating System (SSRS) Problem Behaviors subscale[28]	problem behaviors (e.g., "argues with others")

Classroom Quality

Classroom quality was examined in a sample of pre-k classrooms serving More at Four children in 2003-2004 and in a sample of kindergarten classrooms which these children attended in 2004-2005.

Participants

Pre-k classroom observations were conducted in a random sample of More at Four classrooms in sites that had been in operation during the previous year (2002-03) and were serving children in the current (2003-04) year. The sampling pool included both classrooms in sites that had begun operations during the first year (January-June 2002) and the second year (2002-03) of More at Four. Observations of the global quality of classroom practices were conducted in 99 randomly selected classrooms from 47 More at Four counties/regions. This sample of classrooms included 57 of the 58 classrooms from which the child sample was drawn (one of the 58 classrooms was no longer part of the More at Four program by Spring 2004 when the classroom observations were conducted).

Kindergarten classroom observations were conducted in a sample of 97 of the 248 kindergarten classes attended by children in the 2003-2004 More at Four evaluation study. Four classrooms in private schools and 2 charter school classrooms were excluded from the sampling pool, as were 4 classrooms in which the teacher did not consent to participate in the classroom observations. To ensure that associated classroom data were collected for as many children as possible, all classes with more than one study child were automatically included in the classroom sample (58 classes). A random sample was then drawn from the remaining classrooms with one study child per class (39/187 classrooms with one study child). The 97 classrooms were located in 65 schools in 32 public school districts in 31 counties. Classrooms in the kindergarten sample included 185 study children or 53% of the children who participated in the kindergarten phase of the study.

Procedures

Observations of the quality of the classroom environments were conducted in Spring 2004 (3/19/04-6/3/04) for the pre-K classrooms and in Spring 2005 (3/2/05-5/11/05) for the kindergarten classrooms. Each observation typically lasted 4 to 5 hours per classroom. Data collectors trained by the More at Four Evaluation Team were required to reach a criterion of at least 85% reliability within 1 point prior to gathering data in the field. Reliability data was also collected in the field for 16 classrooms, yielding an average agreement with consensus of 93% (range 83-100%) within one point, average exact agreement with consensus of 83% (range 66-95%), and an average kappa of .85 (range .61-.98).

Global classroom quality was assessed in both preschool and kindergarten classrooms using the Early Childhood Environment Rating Scale-Revised (ECERS-R), an observational rating scale that measures the developmental appropriateness of classroom practices, including the activities and materials provided, the interactions among teachers and children, the physical environment, and the daily organization of the program. The scale contains 43 items arranged into 7 subscales: Space and furnishings, Personal care routines, Language-reasoning, Activities, Interaction, Program structure, and Parents and staff. Each subscale item is rated on a 7-point scale from low to high (where 1 = "inadequate," 3 = "minimal," 5 =

"good," and 7 = "excellent"). In the current study, the total and subscale scores were computed as mean item scores ranging from 1.0 to 7.0, where higher scores indicate better classroom quality. The ECERS-R and its predecessor, the ECERS, have been used in a wide range of early education research studies. The scales have been demonstrated to have good interrater reliability (total scale r = .92) and predictive validity (e.g., Peisner-Feinberg & Burchinal, 1997).[29]

Six of the subscales (Space and furnishings, Personal care routines, Language-reasoning, Activities, Interaction, and Program structure) were used in kindergarten, with one item (staff cooperation) retained from the seventh subscale (Parents and staff). A set of kindergarten modifications[30] for the ECERS-R was used, pertaining to 19 of the 38 items used in kindergarten classrooms. These modifications related to practices and aspects of the environment that are different or are more relevant in kindergarten than preschool settings. For instance, these modifications specified to "allow 'na' if children do not take a nap and do not seem to need one," that data collectors should "consider writing as a communication activity," and that throughout the scale "play activities" should be expanded to include "play/learning activities" (e.g., item #31 Group time/indicator 3.1 is modified to read "some play/learning activities done in small groups or individually").

Appendix B: Additional Tables

Table B1. Pre-k and Kindergarten Mean Scores on Child Outcome Measures for Children with Complete Data (n=270-317)[1]

Domain	Outcome	Pre-k 2003-2004			Kindergarten 2004-2005			Overall Change
		Fall Pre-k Mean (SD) Range	Spring Pre-k Mean (SD) Range	Pre-k Fall-Spring Change Sig. Level[3]	Fall K Mean (SD) Range	Spring K Mean (SD) Range	K Fall-Spring Change Sig. Level[4]	Sig. Level[2]
Language and literacy	PPVT-III receptive language[5]	**86.1** (19.1) 40-124	**90.3** (16.7) 40-126	***	**95.2** (15.4) 40-127	**96.7** (13.4) 40-132	**	***
	WJ-III Rhyming[6]	**2.0** (2.7) 0-15	**4.7** (4.1) 0-15	***	**7.0** (4.3) 0-16	**9.1** (4.3) 0-17	***	***
	Story and Print Concepts[7]	**3.1** (2.2) 0-10	**4.9** (2.5) 0-11	***	**7.4** (2.3) 0-14	**9.2** (2.3) 1-14	***	***
	Naming Letters[8]	**6.5** (8.0) 0-26	**15.3** (9.4) 0-26	***	**21.8** (6.9) 0-26	**24.8** (4.0) 2-26	--	***
Math	WJ-III Applied Problems[5]	**92.7** (15.6) 46-128	**95.3** (13.2) 52-124	***	**98.0** (11.5) 64-131	**100.6** (11.0) 69-131	***	***
	Counting Task[9]	**12.4** (8.3) 1-40	**19.3** (11.3) 1-40	***	**29.2** (11.5) 3-40	**34.1** (9.2) 4-40	***	***

[1] *p < .05, **p < .01, ***p <.001
[2] Repeated measures analyses using a general linear models approach were conducted to test whether there were significant gains in scores over the four time periods, adjusting for classroom.
[3] Repeated measures analyses using general linear models were conducted to test whether fall and spring scores were significantly different, adjusting for classroom.
[4] Repeated measures analyses using general linear models were conducted to test whether fall and spring scores were significantly different, adjusting for classroom.
[5] Indicates standardized, norm-referenced measure with mean=100, SD=15.
[6] Possible range =0-17
[7] Possible range =0-14
[8] Possible range =0-26
[9] Possible range =1-40

Table B1. Pre-k and Kindergarten Mean Scores on Child Outcome Measures for Children with Complete Data (n=270-317)[10] *(continued)*

		Pre-k 2003-2004			Kindergarten 2004-2005			
Domain	**Outcome**	**Fall Pre-k Mean** (SD) Range	**Spring Pre-k Mean** (SD) Range	**Pre-k Fall-Spring Change Sig. Level[12]**	**Fall K Mean** (SD) Range	**Spring K Mean** (SD) Range	**K Fall-Spring Change Sig. Level[13]**	**Overall Change Sig. Level[11]**
Classroom behavior	SSRS Social Skills[14]	**102.8** (14.9) 66-130	**110.1** (14.4) 63-130	***	**101.7** (14.2) 64-130	**107.0** (14.1) 61-130	***	***
	SSRS Problem Behaviors	**97.2** (11.3) 85-138	**97.7** (12.2) 85-145	NS	**98.7** (12.5) 85-133	**98.6** (12.6) 85-137	NS	NS
General knowledge	Social Awareness[15]	**3.6** (1.8) 0-6	**4.5** (1.4) 0-6	***	**4.9** (1.2) 1-6	**5.4** (1.0) 1-6	--	***
	Color Naming[16]	**16.5** (5.4) 0-20	**19.0** (2.4) 5-20	***	**19.7** (1.3) 2-20	**19.9** (0.4) 17-20	--	***

[10] *$\underline{p}$ < .05, **$\underline{p}$ < .01, ***$\underline{p}$ <.001
[11] Repeated measures analyses using a general linear models approach were conducted to test whether there were significant gains in scores over the four time periods, adjusting for classroom.
[12] Repeated measures analyses using general linear models were conducted to test whether fall and spring scores were significantly different, adjusting for classroom.
[13] Repeated measures analyses using general linear models were conducted to test whether fall and spring scores were significantly different, adjusting for classroom.
[14] Indicates standardized, norm-referenced measure with mean=100, SD=15.
[15] Possible range =0-6
[16] Possible range =0-20

End Notes

[1] Smart Start is a comprehensive early childhood initiative created in 1993 to ensure that all North Carolina children enter school healthy and ready to succeed. The program focuses on improving the quality of child care and providing health and family support services to children from birth to age five and their families. Program funds are distributed to 81 community partnerships serving all 100 North Carolina counties. For more information about Smart Start, visit the North Carolina Partnership for Children's website at http://www.ncsmartstart.org/.

[2] For further details, see *More at Four Pre-kindergarten Program Guidelines and Requirements*, January 2005.

[3] Peisner-Feinberg, E. S. & Maris, C.L. (2005). *Evaluation of the North Carolina More at Four Pre-kindergarten Program: Year 3 Report (July 2003-June 2004).* Chapel Hill, NC: FPG Child Development Institute University of North Carolina at Chapel Hill.

[4] Peisner-Feinberg, E.S. (2003). *Child and Program Characteristics of the North Carolina More at Four Pre-kindergarten Program: Year 1 (January-June 2002).* Chapel Hill, NC: FPG Child Development Institute.

[5] Peisner-Feinberg, E.S. & Maris, C.L. (2005). *Evaluation of the North Carolina More at Four Pre-kindergarten Program: Year 2 Report (July 2002-June 2003).* Chapel Hill, NC: FPG Child Development Institute.

[6] Kagan, S.L., Moore, E., & Bredekamp, S. (Eds.) (1995). Reconsidering children's early development and learning: Toward common views and vocabulary. *Goal 1 Technical Planning Group Report 95-03*. Washington, DC: National Education Goals Panel. See also http://govinfo.library.unt.edu/negp/ for a description of the National Education Goals.

[7] A total risk factor score representing risk at entry into pre-k was constructed for each child using information about family income (free/reduced price/full price lunch status) and additional risk factors considered under the 2003-2004 More at Four eligibility guidelines (limited English proficiency, identified disability, and chronic health condition). Total risk scores could range from 0-5, with 2 points assigned for free lunch eligibility, 1 point for reduced-price lunch eligibility, and 0 points for full-price lunch status, and 1 point assigned for each additional risk factor.

[8] The More at Four Program designates a "service priority status" for each child enrolled in the program. Program guidelines define 7 levels of service priority status including 4 levels for unserved children (i.e., those who are not in a pre-kindergarten program) and 3 levels for underserved children (i.e., those who are in a low-quality setting). See http://www.governor.state.nc.us/Office/Education/ProgramInformation1.asp for more information on program guidelines.

[9] English proficiency was determined based on fluency scores on the preLAS 2000, an individual assessment of English proficiency. Fluency scores could range from 1 (non-English speaker) to 5 (proficient English speaker). For the present analyses, we used fluency scores from the fall of pre-K to represent English proficiency levels at entry into the More at Four Program. See Appendix A for more information on study methods.

[10] NICHD Early Child Care Network (2002). Early child care and children's development prior to school entry: Results from the NICHD Study of Child Care. *American Educational Research Journal, 39*, 133-164.

[11] NICHD Early Child Care Network (2005). Early child care and children's development in the primary grades: Follow-up results from the NICHD Study of Early Child Care. *American Educational Research Journal, 42*, 537-570.

[12] A total risk factor score representing risk at entry into pre-k was constructed for each child using information about family income (free/reduced price/full price lunch status) and additional risk factors considered under the 2003-2004 More at Four eligibility guidelines (limited English proficiency, identified disability, and chronic health condition). Total risk scores could range from 0-5, with 2 points assigned for free lunch eligibility, 1 point for reduced-price lunch eligibility, and 0 points for full-price lunch status, and 1 point assigned for each additional risk factor. For the current analyses, a four-level categorical variable was constructed, representing risk factor scores of 0, 1, 2, and 3-5.

[13] Harms, T., Clifford, R. M., & Cryer, D. (1998). *Early Childhood Environment Rating Scale Revised Edition*. New York: Teachers College Press.

[14] The More at Four Program guidelines stipulate that classrooms should have an average total ECERS-R score of 4.5, with classrooms scoring lower being required to develop an enhancement and/or intervention plan to improve environment quality.

[15] Henry, G., Ponder, B., Rickman, D., Mashburn, A., Henderson, L., & Gordon, C. (2004). *An Evaluation of the Implementation of Georgia's Pre-K Program: Report of the Findings from the Georgia Early Childhood Study (2002-03)*. Atlanta, GA: Georgia State University, Andrew Young School of Policy Studies.

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[30] Source: National Center for Early Development and Learning "Additional Notes for Clarification for the ECERS-R" (revision date: 7/18/02), with slight modifications by the More at Four Evaluation Team (2/3/05).

Other More at Four Evaluation Team Publications

Child and Program Characteristics of the North Carolina More at Four Pre-kindergarten Program: Year 1 (January–June, 2002) Report and Executive Summary

Evaluation of the North Carolina More at Four Pre-kindergarten Program: Year 2 (July 1, 2002–June 30, 2003) Report and Executive Summary

Evaluation of the North Carolina More at Four Pre-kindergarten Program: Year 3 (July 1, 2003-June 30, 2004) Report and Executive Summary

Evaluation of the North Carolina More at Four Pre-kindergarten Program: Year 4 (July 1, 2004-June 30, 2005) Program Characteristics and Services Report and Executive Summary

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