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The Effect of Early Childhood Intervention and Subsequent Special Education Services: Findings from the Chicago Child-Parent Centers

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This article explores patterns of special education services during the elementary grades among children who participated in either the Child-Parent Center (CPC) Preschool Program or other early childhood programs in the Chicago Public Schools. The study sample included 1,377 low-income, racial minority children in the Chicago Longitudinal Study. Controlling for family background characteristics that might affect educational performance, children who participated in Child-Parent Center preschool had a significantly lower rate of special education placement (12.5%) than the comparison group (18.4%), who participated in an alternative all-day kindergarten program. The estimated impact of CPC preschool intervention was best explained by the cognitive advantage hypothesis. This article provides support for the long-term impact of the CPC preschool intervention on special education outcomes.

Keywords: *early childhood intervention, education policy, special education, urban education and prevention*

SEVERAL trends in special education services have received ongoing attention over the past 20 years. Foremost, since the passage of the Education for All Handicapped Children Act in 1975, there has been a dramatic increase in the numbers of students receiving special education services (Pruslow, 2001) accompanied by a concurrent increase in the costs for these services. Within this broad social context, specific and ongoing concerns have been raised regarding the consistent disproportionate representation of African Americans participating in special education (Artiles & Trent, 1994; Dunn, 1968, Patton, 1998; Peterson & Ishii-Jordan, 1994).

In response to these social and economic concerns, many efforts have been made to predict who is at risk for eventual placement in special education services. Studies examining significant predictors of special education placement from birth certificate data indicate that poverty is one of the most significant predictor variables in all models (e.g., Goldberg, McLaughlin, Grossi, Tytun, & Blum, 1992). Given the over representation of African American children among people who live at the poverty level in the United States (Corcoran & Chaudry, 1997), it is not surprising that African Americans are also over represented in special education services (Office of Special Education and Rehabilitation Services, 2001). However, research on African Americans and special education has often failed to take into consideration the heterogene-

ity of the African American population and the potential confounding impact of poverty and racial status on special education placement among African American children (MacMillan & Reschly, 1988). Early interventions designed to reduce the negative impact of poverty on children's development (e.g., Head Start), may have an important impact on reducing the number of children with disabilities in special education, and by proxy, reduce the number of poor African American children needing special education services.

Trends in Special Education Participation and Associated Costs

Since the 1975 passage of the Education for All Handicapped Children Act, the number of students receiving special education services in the United States has steadily increased. In its 23rd annual report to Congress, the Office of Special Education and Rehabilitation Services provided the most current statistics regarding special education services and reported that the number of students ages 6–21 served had reached 5,683,707 in 1999–2000, which is 11.4% of all students (Office of Special Education and Rehabilitation Services, 2001). This figure represents a 30.3% increase within a 10-year period since 1990–1991. Of note, this growth in special education far exceeded the growth rate in both school enrollment (13.7%) and resident population of students (12.2%) for the same age group during this time period. Among the 13 categories for which data were collected during the 1999–2000 school year, the four most prevalent disabilities were specific learning disabilities (50.5 %), speech or language impairments (19.2%), mental retardation (10.8%), and emotional disturbance (8.3%). Finally, this report noted that in contrast to other race/ethnic groups, American Indian/Alaska Native and Black (non-Hispanic) participation in special education services exceeded their national resident population estimates by .3% and 5.8% respectively. The Black (non-Hispanic) category was the only race/ethnic group in which their representation in all 13 of the disability categories exceeded their national resident population estimates (Office of Special Education and Rehabilitation Services, 2001). Clearly, the extent of over representation of African Americans in special education is noteworthy and more research is needed in this area.

Not surprisingly, along with the increasing number of students participating in special education, the costs of special education have grown as well. Although many acknowledge the high cost of special education, the amount of expenditures is difficult to estimate accurately (Parrish & Chambers, 1996). This is due, in part, to the complex funding system for special education which includes local, state, and federal sources. Furthermore, it is increasingly difficult to divide expenditures accurately between general and special education. Parrish and Chambers estimated that the cost was about $31.8 billion (i.e., 12% of the 1995–1996 national expenditures for K-12 public education). According to Chaikind, Danielson, and Brauen (1993), the average cost of special education per student was about $7,800 in 1989–1990 dollars or about double that of regular education students. More recent data indicate that during the period from 1989 to 2000, the per-pupil amount for special education provided by federal grants has more than doubled (Apling, 1999). In light of these escalating costs, efforts to reduce costs associated with special education has become a major public policy issue.

Impact of Early Intervention on Special Education Outcomes

Consistent evidence indicates that most early intervention programs of relatively good quality have meaningful short-term effects on cognitive ability (Haskins, 1989; McKey et al., 1985; White, 1985). Additionally, there is increasing evidence of middle to long-term effects on reducing the number of students placed in special education (Barnett, 1995, 1998; Campbell & Ramey, 1995; Consortium for Longitudinal Studies, 1983; Schweinhart, Barnes, & Weikart, 1993). Early intervention research studies are frequently categorized into two distinct groups: model programs and large-scale public programs. Model programs are characterized as intensive single-site interventions with under 500 participants and relatively strong experimental designs (Barnett, 1998; Schweinhart et al., 1993). In contrast, large-scale public programs typically involve multiple sites, include over 500 participants, and utilize a quasi-

experimental design (Schweinhart et al., 1993). Typically, the model programs are higher quality as measured by staff qualifications, closer supervision by experts, smaller group sizes, and lower child-to-staff ratios (Barnett, 1995). However, because of the highly controlled nature of these interventions, their generalizability to the public school environment is limited. Whereas the large-scale pubic programs have greater generalizability, their effect size is generally lower than the model programs and they have greater challenges maintaining internal validity (Schweinhart et al., 1993). Given the unique contributions and limitations that each of these types of intervention studies offer, it is important to review the outcomes of their respective contributions.

Model Programs

Average effects on cumulative rates of special education are generally higher for model programs (e.g., Campbell & Ramey, 1995; Gray, Ramsey, & Klaus, 1982; Levenstein, O'Hara, & Madden, 1983). For example, one study, based upon data from the Carolina Abecedarian Project, randomly assigned 111 participants to the preschool intervention (57) and control (54) groups (Campbell & Ramey, 1995). Long-term special education effects were measured at age 15 (end of 10th grade) and significant statistical differences were found between the preschool intervention group (12%) and the comparison groups (47%) (Campbell & Ramey, 1995). Another model intervention study focused on the impact of preschool intervention on the number of years in special education by the end of high school (Schweinhart & Weikart, 1983). This study indicated that only 19% of the experimental group had received special education services for one year or more compared to 39% of the control group. Furthermore, this study also found a significant difference between the years in special education by group, with the experimental group receiving .92 years and the control group receiving 2.10 years.

Large-Scale Public Programs

Very few high-quality large-scale public program studies investigating long-term special education outcomes have been conducted. Nonetheless, similar to model programs, some large-scale public programs have provided evidence that early intervention can lead to reduction in need for subsequent special education services (e.g., Barnett, 1995, 1998; Irvine, 1982; Reynolds, Temple, Robertson, & Mann, 2001). However, the magnitude of the special education percentages was significantly higher for model programs compared to the public programs (Barnett, 1998). Although a number of large-scale studies found lower percentages of intervention group participants receiving subsequent special education services, these differences were not always statistically significant, and many of these studies have significant problems with attrition (Barnett, 1995). More research is needed in this area to provide a better understanding of the impact of long-term interventions, especially with respect to different types of disabilities. For example, primarily because of limitations in sample size, previous studies of large-scale and model programs did not investigate group differences by category of special education placement.

Explanatory Hypotheses for Early Intervention Impact

Many hypotheses have been offered to explain the link between preschool intervention and long-term outcomes (Barnett, Young, & Schweinhart, 1998; Reynolds, 2000; Royce, Darlington, & Murray, 1983). The two major ones are the cognitive advantage hypothesis, and the family-support hypothesis. Only one study of a model program has explored each of these hypotheses for the long-term impact of cognitive development and school success (Barnett et al., 1998), and few, if any, studies have explored impacts for learning disabilities and other categories of special education placement. Importantly, little has been done to explore how these two hypotheses would relate specifically to the area of special education placement, particularly in a public program using a large scale, multisite, longitudinal design.

Cognitive Advantage Hypothesis

This hypothesis indicates that the effects of intervention are initiated by improvements in developed abilities as measured by standardized tests of cognitive maturity, language, and literacy skills. The cognitive stimulation experienced in center-based education is expected to promote a cycle of positive behavior that culmulates in school achievement, academic outcomes, and educational success (Campbell & Ramey, 1995; Ceci, 1991;

Reynolds, 1996; Zigler, Abelson, Trickett, & Seitz, 1982). This hypothesis has been used to understand the effects of early intervention programs such as the High/Scope Perry Preschool Program (Berrueta-Clement, Schweinhart, Barnett, Epstein, & Weikart, 1984; Consortium for Longitudinal Studies, 1983; Schweinhart et al., 1993).

Family Support Hypothesis

The family support hypothesis suggests that because of the impact of the intervention on parents' attitudes and beliefs, family processes are changed, and these changes lead to long-term effects on the child's development (Scott-Jones, 1984; White, Taylor, & Moss, 1992). Generally, research reviews indicate that early intervention programs are more effective if they actively involve parents (Reynolds, 1996). Many early intervention programs expect active participation from parents who then are exposed to experiences designed to enhance parent-child communica-tion and parent involvement with the educational system.

Purpose of Study

While many suggestions have been made to reduce the overrepresentation of ethnic minorities in special education, little research has been done to empirically investigate these options, especially those associated with poverty (Serna, Forness, & Nielsen, 1998). This study examines the effect of a federally funded early intervention, the Chicago Child-Parent Center (CPC) program, on subsequent special education services within a predominantly urban, low income, African American sample. Three major questions were addressed: (a) What are the patterns of special education services among a sample of urban African American children who live below the poverty level? (b) Does participation in the CPC preschool program reduce the likelihood of receiving special education services during elementary grades for students with varied types of disabilities? (c) Is the relation between CPC preschool program participation and special education placement explained by the cognitive advantage and family support hypotheses?

Method

Sample

The sample for this study came from the 1999 Chicago Longitudinal Study (CLS), (Chicago Longitudinal Study 1999), a comprehensive investigation of the effects of the Child-Parent Center (CPC) Program in Chicago from 1985–1986 to the present. The original sample of 1,539 low-income, predominantly African American children was selected as a representative sample of children participating in government-funded kindergarten programs in 1985–1986. Entry into these programs required residency in school neighborhoods eligible for the Elementary and Secondary Education Act Title I services. Families of the 989 CPC preschool participants voluntarily enrolled their children in the CPC preschool program (Reynolds, 1995). However, to reduce the effect of family selection, a school-community representative in each CPC went door-to-door in each neighborhood to seek participation and made extensive efforts to enroll children with the greatest levels of educational need. The reason that most of the 550 children in the comparison group (68%) did not enroll in the program was because they did not live in the attendance area of the CPCs. Thus, primarily home residency rather than parent interest affected participation. The comparison group was randomly selected from Chicago public schools that matched the school characteristics of the intervention group (e.g., eligibility for government funded early childhood programs, participation in early childhood programs, and school neighborhood poverty). Comparison group children did not receive the CPC preschool intervention. By comparing groups that received different intervention services, findings in this study estimate the value added by the CPC program above and beyond participation in an alternative intervention that itself provided educational and family-support services (Reynolds, 2000; Reynolds et al., 2001). This attribute may lead to conservative estimates of effects. Moreover, previous studies in this project, which included school readiness, reading and math achievement, grade retention, and special education as outcome measures, support the equivalence of the program groups and show no evidence of selection bias as assessed by simultaneous equation models (Reynolds & Temple, 1995, 1998). Major contributors to these findings are that over 80% of eligible children from the neighborhoods enroll in the centers and that program staff make significant efforts to enroll children most in need. However, no previous studies have investigated impacts on different categories of special education placement.

The sample for the current study consisted of 1,377 CLS children (89.5% of the original sample) who were active in the Chicago Public Schools for at least four years during grades 1–8. This included 895 children (90.5% of original sample) who enrolled in the CPC preschool program and a comparison group of 482 children (87.6% of original sample) who did not receive the CPC preschool intervention. No differential or selective attrition was found between the current study sample and the original kindergarten sample of 1,539. For example, a *t*-test of the basic composite scale, Form 7, Level 5 of the Iowa Tests of Basic Skills Early Primary Battery, (ITBS), (Hieronymus, Lindquist, & Hoover, 1980) at kindergarten entry for the study sample and the attrition sample were statistically equivalent ($p = .248$) and there was no program by sample recovery status interaction in the *F* test for the ITBS composite scale ($p = .802$) and for family background characteristics (e.g., for parent education or free lunch status).

As shown in Table 1, sociodemographic background characteristics were similar between program and comparison groups in the study sample ($p > .05$) for gender, race, eligibility for free lunch, school poverty level, and the family risk index, a sum of six dichotomous variables associated with lower rates of school performance (e.g., low family education, single-parent family status, eligibility for free lunch program, parent not employed). Relative to the comparison group, a greater percentage of CPC participants had parents who were high school graduates. Alternatively, CPC participants were more likely to reside in families in which the parent was not employed. These differences were taken into account by including these variables in the statistical analysis as part of the family risk index. CPC program and comparison groups also were similar on single-parent family status and incidence of child maltreatment by age 3. A similar pattern of results occurred for the original kindergarten sample, suggesting inter-group equivalence among the original kindergarten sample. For example, the study sample and attrition sample had identical mean scores on the basic composite scale of the ITBS ($p = .248$).

Intervention

The CPC program is funded by Title I of the Elementary and Secondary Education Act, which provides federal funds to school districts with large portions of low-income students. Like Head Start and other preschool interventions for children at risk, the CPC preschool program is a structured half-day morning program for 3- and 4-year old children, which emphasizes school readiness skills

TABLE 1
Sample Characteristics for CPC Preschool Participants and the Comparison Group

Mediator	CPC preschool ($N = 895$)	Comparison group ($N = 482$)	Test statistic*	*p* Value	Original sample *p* value
Percent girls	52.0	48.0	3.183	.076	.100
Percent African American	93.3	93.0	.060	.806	.949
Mean family risk index	3.11	3.08	.150	.699	.176
Percent parents who are high school graduates at child's birth	61.9	55.4	5.183	.023	.008
Percent eligible for free lunch by child's age 8	73.9	70.9	1.357	.244	.080
Percent missing on parents' highschool graduation status or free lunch	4.0	5.8	2.257	.133	.020
Percent abuse/neglect by child's age 3	0.2	0.8	2.656	.103	.048
Percent single parent by child's age 8	57.3	59.7	.569	.451	.385
Percent parents not employed by child's age 8	59.4	52.8	4.315	.038	.036
Percent school poverty level is 60% plus	77.7	73.4	3.059	.080	.037

Note. Total sample sizes were 1,377 except for parent not employed ($n = 1,069$), parent education ($n = 1,315$), single parent ($n = 1,071$), and eligibility for free lunch ($n = 1,375$).
*Test statistics are Pearson chi-squares except for the family risk index, which is *F* statistic.

and the provision of comprehensive services. These services include attending to children's nutritional and health needs; coordinating adult supervision; providing funds for centralized in-service teacher training in child development, and for instructional supplies; and emphasizing reading readiness through reduced class size, reading and writing activities in the learning center, and reinforcement and feedback. Each center tailored its program to children's needs through a common core of activities that included individualized instruction, small-group activities, whole group reading and writing activities, and field trips.

As the name of the CPC program suggests, direct parent involvement is a critical component of this intervention. As such, parents were required to spend at least one-half day per week in school activities. These activities included participating in educational workshops, volunteering as classroom aides, attending school events, interacting with other parents in the parent-resource room, and attending parent-teacher meetings on behalf of the child. The comparison group children did not receive any CPC preschool intervention, however, some did receive Head Start preschool intervention. On average, attendance rates for the intervention group in preschool and kindergarten and for the comparison group in kindergarten exceeded 90%.

Although the focus of this article is on the CPC preschool programming, it is important to note that the CPC program provided the opportunity for up to 4 years of follow-on intervention through grade 3. The kindergarten component provides all day (6 hour) services to promote reading readiness and effective development. The primary-grade component provides extended intervention services for increased learning opportunities through reduced class size, parental involvement activities, and instructional coordination. All of the intervention and comparison group children participated in kindergarten. It is noteworthy that comparison group children participated in an enriched full-day kindergarten program, which was more than the usual intervention provided in the mid-1980s. Among this group 68% of the students comprised the entire kindergarten class in five randomly selected schools that provide kindergarten programs and additional instructional resources (22% enrolled in Head Start). The remaining 32% of the comparison group children attended full-day kindergartens in six CPCs without preschool participation.

Table 2 presents the level of program participation for Child-Parent Center and comparison groups in the Chicago Longitudinal Study. Because both children who participated in the CPC preschool intervention and those from the comparison group experienced varied levels of the CPC kindergarten and primary-grade follow-on services, we do statistically control for follow-on participation in our analyses of the effects of CPC preschool.

Program Measures

A quasi-experimental longitudinal panel research design was used to address the research questions. The measure of participation in CPC

TABLE 2
Levels of Program Participation for Child-Parent Center and Comparison Groups in the Chicago Longitudinal Study

Sample Characteristic	CPC Intervention Group	Comparison Group
Number of cases with known status for special education services at age 15	895	482
Preschool participation, %	100	15.4
Number of cases, 1 year	413	34
Number of cases, 2 years	482	40
Mean number of years	1.54	0.24
Kindergarten participation, %	100	100
Full-day program, %	59.3	100
School-age participation, %	73.2	31.5
Number of cases, 1 year CPC	108	28
Number of cases, 2 or 3 years CPC	547	124

Note. Preschool participation of the comparison group was in Head Start. CPC participation began at age 3 and could continue to age 9 (third grade) in selected elementary schools.

preschool program was categorical (0 = none, 1 = any).[1] Since many of the study participants received varied levels of CPC intervention following preschool, these follow-on services were statistically controlled to better evaluate the unique effect that the CPC preschool intervention had on subsequent special education services. The follow-on variable was categorical (0 = none, 1 = any).

Covariates

Consistent with previous studies, several child and family variables that may be correlated with both the parents' decision to enroll their child in the CPC intervention and the educational outcomes were included as covariates in the regression analyses. These variables included (a) gender of the child (0 = boy; 1 = girl), (b) parent educational attainment (0 = no high school degree; 1 = high school graduate), (c) eligibility for subsidized lunch (0 = not eligible; 1 = eligible), (d) percent of children residing in school attendance area in which 60% or more of families are low-income at kindergarten (0 = less than 60%, 1 = 60% or greater), (e) race (0 = not African American; 1 = African American), and (f) if children were missing information on parent education or free lunch status. Following Cohen and Cohen (1983), the missing-data variable assesses the impact of incomplete data in the model. These variables were included to reduce any possible influence of self-selection. Results were unaffected by the addition of grade retention as a covariate and program site dummy variables which measure the influence of enrollment at different sites.[2]

Mediators

Two mediating variables were included in the analysis to examine the effect of the cognitive advantage and family support hypotheses. These variables were measured by cognitive composite at age 5 and parent participation in school, respectively. Each are believed to be instrumental to program effectiveness (Sullivan, 1971)

Cognitive composite at age 5

To investigate the cognitive advantage hypothesis of the effects of preschool participation, we used the basic composite scale of the Iowa Tests of Basic Skills Early Primary Battery (Hieronymus, Lindquist, & Hoover, 1980). Assessed at kindergarten entry in the fall of 1985, this measure of cognitive maturity includes five subscales: listening skills, word analysis, language, vocabulary, and mathematics. In this untimed test, a non-classroom teacher orally presented the items to children by over a one-week period. The composite battery has high reliability (coefficient = .94) and predictive validity (Reynolds, 2000). We analyzed developmental standard scores (based on 1988 norms) after imputing missing cases with their respective program or comparison-group means. They have equal-interval scale points and index continuous development over the grade years. The national average was 51.

Parent participation in school

The family support mediating variable was defined as the frequency that parental school participation was rated "average/a fair amount" or better by teachers and parents over the grades 2–6. School involvement is a key component of the program theory (Sullivan, 1971) and is a measure of the family-school partnership. Classroom teachers responded to the item [Rate for this child] "parent's participation in school" for five consecutive years. The sum of these five ratings was added to the sum of two parent-reported ratings on school participation between grades 2–6 (i.e., "How often did you participate in child's school?"). For the analysis, we used the frequency of "average" or better ratings (Min. = 0, Max. = 5). Prior analyses have indicated that ordinal and dichotomous coding of these items yield similar patterns of relations among variables. The use of dichotomous variables was selected for this study to enhance conceptual clarity and to reduce possible "halo" effects. Teacher and parent ratings of involvement are significantly correlated (r = .30), indicating that they provide overlapping but distinct information and provide a more comprehensive measure than ratings from a single source (Reynolds et al., 1996). Both ratings have demonstrated adequate levels of construct validity as determined by factor analysis and measurement reliability (alphas > .90), and have been shown to mediate the effects of program participation on a variety of child and family outcomes (Reynolds, 2000; Reynolds et al., 1996). These ratings have also been significantly associated with school achievement and with participation in the CPC program (Reynolds, 1995).

Special education measures

Two special education outcome measures were used to evaluate the effects of the CPC preschool

program on participation in special education services from first grade through eighth grade. Data came from centralized Chicago school system records.

Incidence of special education

The first outcome measure was defined as whether children had any placement in special education. Children assigned to special education services in any of grades 1–8 were coded 1; all others were coded 0. To determine if program participation led to reductions in special education services for different types of disabilities, we distinguished placement for emotion or behavior disorder (EBD), specific learning disability (LD), speech and language impairments (SPL), and mental retardation (MR). Each of these categories was coded 0 if the participant did not have that specific disability or 1 if they did.

Number of years in special education

This indicator was a count of the number of years receiving any special education services from first grade through eighth grade. This measure ranged from 0 to 8 years. As with incidence, the number of years receiving different categories of placement was also analyzed. Due to the nonnormality of these count data, negative binomial regression analysis was used to obtain accurate estimates of statistical significance.

Data analysis

Descriptive and regression analyses were used to address the major research questions. Descriptive analyses provided a picture of the patterns of special education placement both on an annual basis and cumulatively. To assess the effectiveness of the CPC preschool program on reducing the likelihood of receiving special education services over elementary grades, probit and negative binomial regression analyses were conducted in STATA, first for the overall sample, and then on students with emotional or behavior disorders, specific learning disabilities, speech and language impairment, and mental retardation. Probit regression analyses were used to analyze the discrete outcome variable *any* verses *no* special education and negative binomial regression analyses were used to analyze the linear outcome variable, years in special education services (0–8). Since probit and negative binomial coefficients are not directly interpretable, they were transformed in STATA to marginal effects, which are similar to metric regression coefficients in ordinary regression analysis. Probit coefficients were interpretable as the percentage-point difference between intervention groups after adjusting for the covariates, and are derived from the partial derivative evaluated at the mean of the explanatory variable (Greene, 1995). Negative binomial regression coefficients for the count data of years in special education were interpretable as the mean group difference in years of special education adjusted for the covariates.

Following Cohen and Cohen (1983), we used hierarchical regression analysis. The program measures were entered to determine raw (unadjusted) group difference between the intervention and comparison groups. This unadjusted group difference provides a baseline comparison for the other models. The unadjusted group difference is a valid indicator of intervention effects when equivalent groups are being compared. Second, the demographic covariates, which may be correlated with program participation or special education placement, were entered to get an adjusted estimate of the group differences. To assess any possible impact of selection bias as measured by these variables, the effect of the unadjusted model is compared to the effect of the adjusted model. Finally, each of the mediator variables is entered individually and then together to assess the level of mediation of the cognitive and family involvement variables. When the adjusted effect becomes nonsignificant after entering the mediators then it can be concluded that the mediators explain, at least in part, the estimated main effect of program participation (Cohen & Cohen, 1983).

Results

Study findings are reported for the three research questions. (a) What are the patterns of special education services among a sample of urban African American children who live below the poverty level? (b) Does participation in the CPC preschool program reduce the likelihood of receiving special education services during elementary grades for students with varied types of disabilities? And, (c) Is the relation between CPC preschool program participation and special education placement explained by the cognitive advantage and family support hypotheses?

What are the Patterns of Special Education Services Among a Sample of Urban African-American Children?

Figure 1 provides a comparison of the unadjusted and adjusted rates of placement in special education by program group. With no adjustment, the CPC group experienced a lower rate of special education services, as 13.1% of the CPC group received services compared to 20.8% in the comparison group ($p < .001$). Controlling for the covariates (i.e., school poverty, lunch status, parent education, gender, and race and CPC follow-on intervention, the rate of special education placement was 12.5 % for the CPC group and 18.4% for the comparison group ($p < .01$), a 32% reduction.

Table 3 provides the adjusted means for indicators of special education placement and number of years of special education, including those for emotional or behavioral disorder, mental retardation, specific learning disability, and speech and language placement. When examining the results by type of disability, we can see that specific learning disability is the only type of disability where there is a significant difference between the CPC group and the comparison group (5.8% vs. 9.3%; $p = .023$). However, the difference in rates of mental retardation is marginally significant (0.6% vs. 1.5%, $p = .057$) in favor of the preschool group. Although the low incidence of mental retardation reduced the power to detect differences, the rate for the preschool group was 60% lower than the comparison group.

To better understand how the program effects came about, we also examined the adjusted rates of special education by grades and present this information in Figure 2. On a year-by-year basis, the CPC group consistently had fewer students who received special education services than did the comparison group. These differences were statistically significant (t test) in grades 1($p < .01$), 3 ($p < .01$), 4 ($p < .01$), 5 ($p < .05$), and 6 ($p < .05$), indicating that the effect of the intervention begins to take place in the first grade. The largest mean differences occurred in the third through sixth grades with the largest (6 points) in the fourth grade. Overall, the rate of special education place-

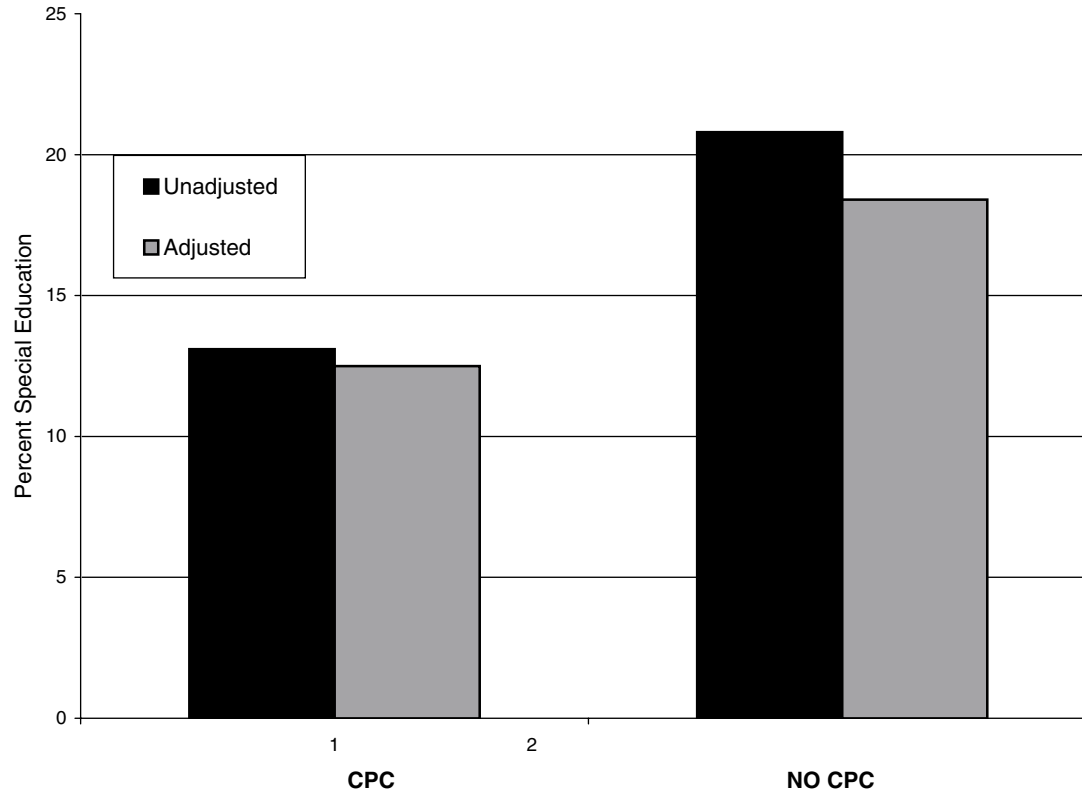

FIGURE 1. *Percent unadjusted and adjusted by CPC preschool vs. no CPC preschool.*

TABLE 3
Adjusted Means for Indicators of Special Educational Placement

Indicator of Special Educational Placement Grade 1–8	CPC Preschool group ($N = 895$)	Comparison group ($N = 82$)	p Value
Incidence of special education placement by disability type			
Ever in special educational placement, %	12.5*	18.4	.007
Ever in emotional or behavioral disorder placement, %	1.8	1.8	.268
Ever in mental retardation placement, %	.6	1.5	.057
Ever in specific learning disability placement, %	5.8**	9.3	.023
Ever in speech and language impairment placement, %	3.6	5.3	.182
Incidence of special education placement by grade			
In special educational placement at first grade, %	.5*	3.2	.001
In special educational placement at second grade, %	2.5	3.8	.204
In special educational placement at third grade, %	5.2*	10.2	.002
In special educational placement at fourth grade, %	5.8*	11.8	.001
In special educational placement at fifth grade, %	6.7**	11.0	.016
In special educational placement at sixth grade, %	8.7**	13.7	.012
In special educational placement at seventh grade, %	9.5	13.2	.065
In special educational placement at eighth grade, %	9.1	13.0	.053
Number of years in special education placement by disability			
Number of years in special educational placement	.47*	.69	.006
Number of years in emotional or behavioral disorder placement	.13	0	.974
Number of years in mental retardation placement	.02	.05	.089
Number of years in specific learning disability placement	.21**	.33	.022
Number of years in speech and language impairment placement	.10	.14	.187

Note. Adjusted for follow-on participation, gender, Black, parent education at child's age 10, if ever received free lunch at child's age 10, if missing from parent education or free lunch status, and if income level is 60% + poverty for school area. If ever in mental retardation placement is not adjusted for Black, because all kids who had placement were Black. Tests of significance are from probit and negative binomial regression in STATA.
**$p < .05$., *$p < .01$.

ment tended to increase steadily for both groups in each grade, although there is a minor decrease in the rate of special education in the comparison group from fourth grade to fifth and following the sixth grade. The intervention group has a steady increase in special education until the eighth grade, when it declines minimally. During the third and fourth grades the rate of special education placement among the CPC group is about half of the comparison group.

We also explored the pattern of the number of years spent in special education among the participants who received special education services and present this information in Figure 3. This figure contrasts the cumulative number of years spent in special education among those who received special education services ($N = 217$) by the CPC group ($N = 117$) and the comparison group ($N = 100$). From this figure we can see that although the CPC preschool intervention group had more students who spent up to four years in special education, it had substantially fewer students who spent five or more years in special education (30% vs. 48%; $p = .006$). Among those receiving special education services, the CPC group had a mean of 3.5 years compared to 4.2 years for the comparison group ($p = .018$). When we look at the results by disability type, specific learning disability was the only category in which a significant difference between groups in years of special education was found.

Does Participation in the CPC Preschool Program Reduce the Likelihood of Receiving Special Education Services During Elementary Grades?

Results of the probit regression analysis for any special education received by the overall sample are presented in Models A and B in Table 4 (findings for Models C to E are described in the sec-

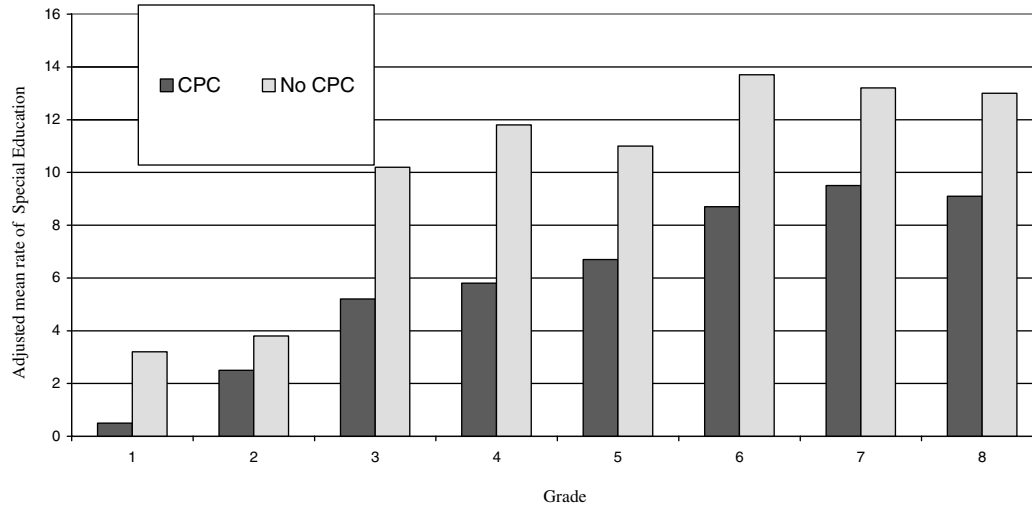

FIGURE 2. *Adjusted mean rates of children placed in special education by grade.*
Note. Light shaded bars represent significant difference $p < .05$.

tion on mediation). In Model A, the intervention variables were entered as a set (Participation in CPC preschool and CPC follow-on services) to evaluate the impact of the preschool intervention while statistically controlling for any impact of follow-on services (e.g., kindergarten or primary-grade CPC intervention). CPC preschool participation was associated with a significantly lower rate of special education. Preschool participants had a 7 percentage-point lower rate of special education placement than the comparison group. Participation in the follow-on intervention was not significantly associated with special education placement.

In Model B, the intervention variables were entered first and followed by the covariates. The program coefficient of –.06 indicates that preschool participants had an adjusted rate of special educa-

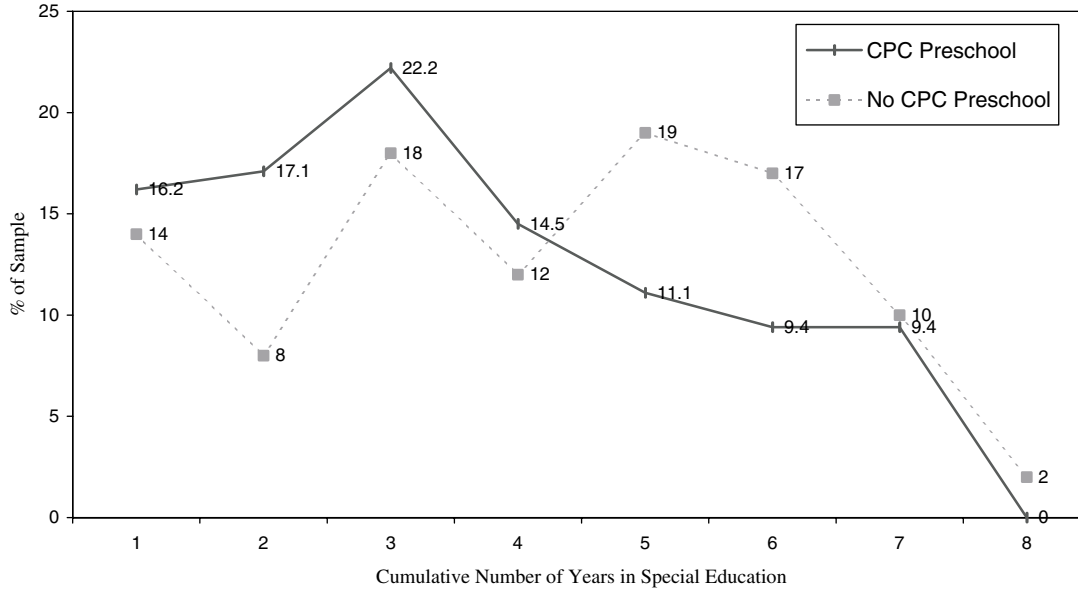

FIGURE 3. *Percent placed in special education spending cumulative number of years in special education by CPC versus no CPC.*

TABLE 4
Marginal Effects from Probit Regression Model Predicting if Ever in Special Education Placement (Grades 1–8)

Predictor	Model A	Model B	Model C	Model D	Model E
Program					
Preschool participation	–.07**	–.06**	–.02	–.06*	–.02
Follow-on participation	–.02	-.02	–.01	–.02	–.01
Sociodemographic factors					
Girls		–.15**	–.12**	–.14**	–.12**
Black		.06	.07*	.05	.06*
Parent not completed high school at child's age 10		.04	.02	.03	.02
Ever reported free lunch at child's age 10		.08**	.05	.08*	.05
If missing from parent education or free lunch status		.08	.04	.06	.03
If living in a area that income level is 60% + poverty for school area		.03	.03	.03	.03
ITBS readiness at kindergarten			–.01**		–.01**
Parent involvement ages 8–12				–.02*	.01
Log likelihood	–592.98	–566.1	–542.60	–563.37	–541.85
LR χ^2	13.83	67.58	114.57	73.04	116.09
Prob > χ^2	.001	.000	.000	.000	.000
Pseudo R^2	.01	.06	.10	.06	.10
Number of cases	1377	1377	1337	1377	1377

Note. Missing values of ITBS readiness were plugged in. Indicator of missing values was used in the model, and it is not significant.
*$p < .05$, **$p < .01$.

tion placement that was 6 percentage points lower than the comparison group. This difference between groups is nearly identical to that of Model A. We note that the addition of alternative covariates such as parent unemployment, single-parent family status, program sites, and grade retention yielded the same pattern of findings. With the incidence of specific learning disabilities as the outcome, Models A and B indicated that the group difference was 4 percentage points, in favor of the CPC group.

Results of the negative binomial regression analyses for years in special education are presented in Table 5. The models in this analysis follow the same format as the probit regression analysis. In Model A, CPC preschool participants spent, on average, .27 fewer years (about 3 months) in special education than the comparison group. After controlling for demographic variables and the influence of follow-on services in Model B, the adjusted mean difference between groups was nearly identical (about 2 and one half months). This consistency in the estimated effects of preschool in both Models A and B suggests groups were unaffected by family background. Once again, these findings were unchanged by the addition of other covariates such as parent unemployment, program sites, and grade retention.

Further analyses were also conducted to investigate the number of years receiving services for specific learning disabilities. Models A and B indicated that program participants spent, on average, .16 and .13 fewer years in special education, respectively ($p < .05$). Follow-on intervention was not associated with years in special education.

Is the Relation Between CPC Preschool Program Participation and Special Education Placement Explained by the Cognitive Advantage and Family Support Hypotheses?

One way to determine the degree to which the cognitive advantage and the family support hypotheses help to explain the CPC program outcome is to explore the reduction in the effect size associated with the cognitive readiness and family involvement mediator variables. If a medi-

TABLE 5
Marginal Effects from Negative Binomial Regression Model Predicting Number of Years in Special Education Placement (Grades 1–8)

Predictor	Model A	Model B	Model C	Model D	Model E
Program					
Preschool participation	–.27**	–.23**	–.09	–.21*	–.09
Follow-on participation	–.05	–.06	.04	–.05	.04
Sociodemographic Factors					
Girls		–.47**	–.43**	–.46**	–.42**
Black		.18	.24*	.15	.23*
Parent not completed high school at child's age 10		.12	.07	.09	.06
Ever reported free lunch at child's age 10		.25**	.18	.24**	.18
If missing from parent education or free lunch status		.27	.14	.19	.10
If living in a area that income level is 60% + poverty for school area		.09	.10	.08	.10
ITBS readiness at kindergarten			–.03**		–.03**
Parent involvement ages 8–12				–.07*	–.04
Log likelihood	–1034.78	–1007.92	–984.49	–1005.20	–983.73
LR χ^2	0.00	0.00	.00	.00	.00
Number of cases	1377	1377	1377	1377	1377

Note. Missing values of ITBS readiness were plugged in. Indicator of missing values was used in the model, and it is not significant. *$p < .05$, **$p < .01$.

ator variable accounted for the entire program effect, we would expect the reduction in program effect to be close to 100% once the mediator variable was entered into the equation, although this rarely happens in practice. At a minimum, the addition of the mediator to the model should change the statistical significance of the program coefficient to nonsignificance if mediation is present (Cohen & Cohen, 1983). This indicates that the mediator is accounting for a portion of the estimated main effect of the program. We will provide the results by the cognitive readiness mediator, the family support mediator, and the combined impact of both of these mediators together.

Cognitive advantage mediator

Model C in Table 4 represents the program effects for the rate of special education placement once the cognitive readiness variable is taken into account. In this analysis, the intervention variables were entered as a set (i.e., participation in CPC preschool and CPC follow-on services) followed by the demographic covariate set (i.e., gender, parent education, subsidized lunch, low-income, race, if missing from parent education or free lunch status) and then by ITBS readiness at kindergarten entry. From Table 4, we can see that ITBS readiness at kindergarten is a significant predictor of special education placement by eighth grade and mediates the association between CPC preschool participation and special education placement. Not only does the coefficient for preschool participation change to nonsignificant when ITBS scores are entered, but there is a 66.7% decline in preschool coefficient (from 6 points to 2 points. This 4-point reduction is associated with the cognitive advantage hypothesis.

Further analyses were done to investigate the impact of CPC preschool on special education placement for learning disability. Since type of disability was not measured in year 2, this analysis is based on data from 1st and 3rd-to-8th grades. The pattern of findings was the same as the addition of ITBS readiness scores reduced the preschool coefficient from 4 percentage points to 1 percentage point (a 75% reduction). This is substantial mediation of the program-outcome relation.

Model C in Table 5 presents the cognitive mediation analyses using the number of years in special education outcome variable. From this

table, we can see that the cognitive readiness variable also mediates the association between CPC preschool participation and number of years in special education. The coefficient for CPC preschool participation changes to nonsignificant (from .23 to .09) when the cognitive readiness variable is entered. This represents a 61% reduction in the main effect associated with cognitive advantage (.14/.23). We found a similar pattern of mediation for the outcome of learning disability.

Family Support Mediator

Model D in Table 4 represents the program effects for rates of special education once the family participation in school variable is taken into account. This analysis followed a similar procedure to Model C. The coefficient for CPC preschool is unchanged when the family participation measure is added, indicating it does not mediate the effect of preschool participation on special education placement. Yet, family participation in school was independently associated with lower levels of special education placement. A 1-point change in parent participation rating was associated with a 2-percentage point reduction in special education. This indicates that family participation is a predictor of special education placement but not a mediator of the link between preschool and special education placement. Further analyses investigating the outcome specific to learning disability reveal similar results in that the coefficient for CPC preschool does not change to nonsignificant. However, the coefficient does decline a small amount from –.04 to –.03 and the parent participation in school is not significantly associated with special education placement.

Model D in Table 5 presents the family support analyses using the number of years in special education outcome variable. From this table, we can see that the family support variable does not mediate the association between CPC preschool participation and number of years in special education. The coefficient for CPC preschool participation was largely unaffected by the inclusion of family participation in school as the coefficient dropped from –.23 to –.21, a small change. Nevertheless, family participation continued to be a significant predictor of years in special education ($b = –.07$, $p < .01$). A similar pattern was found for the outcome of years receiving special education services for learning disabilities.

Cognitive Readiness and Family Support Combined

Model E in Table 4 represents the program effects for rates of special education when both the family and cognitive variables are entered together after the program participation and the covariates. This model contributed little to the mediation of preschool effects. Indeed, the reduction in the size of the preschool coefficient in Model E is the same as Model C. Thus, the ITBS variable contributes the most to the explanation of the main effect between preschool and special education placement. However, this combined model shows that the cognitive advantage hypothesis mediates the link between preschool and special education placement above and beyond the influence of the family support hypothesis. Findings were the same for the outcome of learning disabilities and for years in special education (see Table 5) and receiving services for learning disabilities.

Discussion

The purpose of this study was to examine the effect of the Child-Parent Center (CPC) preschool program on subsequent special education placement within a predominantly low-income, African American sample. In response to the three main research questions, this study makes several contributions to the literature on early childhood intervention. First, this study provides evidence that a high-quality large-scale public program can have long-term effects on special education outcomes. Most previous findings are based on demonstration programs that have limited generalizability to state and federal programs. The findings that preschool participation was associated with significantly lower rates of special education come from a school-based program funded by Title I. Second, this study provides greater detail regarding special education outcomes for the four most prevalent types of disability: specific learning disability, speech or language impairments, mental retardation, and emotional or behavioral disorder. No previous studies have investigated links between preschool and different placement categories over time. We found that compared to other categories of placement, rates of learning disabilities were impacted most, which is consistent with the program's emphasis on literacy and school achievement. We also found that CPC

preschool participants had a substantially lower rate of placement for mental retardation, although the low incidence for both groups decreased the power to detect differences at the .05 level-of-significance. Finally, this study investigated the mediators of the observed effects of preschool participation on special education outcomes. Few, if any, prior studies have specifically investigated the sources of these effects. The findings indicate that at least for special education outcomes, the cognitive advantage hypothesis as measured by school readiness test scores is the primary source of reductions in special education placement.

Impact and quality of large-scale programs on special education outcomes

In a review of literature on the effects of early childhood programs on cognitive and school outcomes, Barnett (1995) notes that the extent to which early childhood programs provide long-term benefits in children's school success is somewhat controversial. This is due, in part, to the fact that not all intervention studies provide evidence of long-term benefits. In this study, we found that the CPC preschool intervention group had a 32% lower rate of special education placement during the elementary grades than the comparison group. This was found after controlling for such covariates as gender, parent education, and participation in follow-on services. Although this effect is not as large as the 40% to 50% reductions produced by some model intervention programs such as the High/Scope Perry Preschool, it is larger than the effects of most other large-scale programs (Barnett, 1995). Among the reasons for this are the CPC program's long history of successful implementation, its intensive focus on school readiness, and that all teachers have bachelor's degrees with certification in early childhood (Reynolds, 2000; Sullivan, 1971). A substantial part of the group differences in our study were due to reductions in placement for learning disabilities rather than for emotional disorders or speech and language deficits, though the pattern of findings favored the preschool group. We also found that CPC preschool group spent an average of 2.5 fewer months in special education over the elementary grades. While these effects are generally smaller than those in model interventions, it is also important to discuss the practical significance of these outcomes. Model programs have higher costs per child and can largely avoid the administrative difficulties of implementation on a wider scale. Although the large-scale interventions have lower effect sizes, they also can have an impact on a much larger number of children. This is particularly relevant when we consider the impact on reducing the escalating costs of special education services.

To get a better understanding of when the impact of the CPC preschool intervention took effect, this study also provided an in-depth description of the cumulative patterns of elementary school special education placement. Children who participated in the CPC preschool intervention showed a different pattern of special education services than those in the comparison group. The comparison group children consistently had higher rates of special education placement and participated in special education services for more extended periods of time than did the intervention group. For example, 48% of the comparison-group children in special education received services for five years or more compared to 30% for the intervention group. More specifically, when we review the adjusted mean rates of children's special education placement rates by grade, we can see that there was a significantly different rate between the intervention and comparison group during the first grade. This is important because some have argued that the link between preschool and first grade is key to understanding the long-term effects of preschool interventions (e.g., Entwisle, 1995). This theory suggests that because preschool interventions boost children's performance, it can reduce the impact of low teacher and parental expectations and negative tracking in the school (Entwisle, 1995). In support of this tracking process, previous reports in the Chicago study (Reynolds et al., 2001; Reynolds & Temple, 1998) and in others (Barnett, 1995; McKey et al., 1985) indicate that program participation can reduce rates of grade retention and enhance classroom adjustment. In the present study, significant differences between the CPC preschool intervention group and the comparison group are also noted during grades three through six. Given that learning disabilities are not generally diagnosed until the third grade, this pattern likely reflects the impact of the CPC preschool intervention on reducing the rates of specific learning disability in special education.

Cognitive Advantage and Family Support Hypotheses

This study also investigated the degree to which the cognitive advantage and family support hypotheses contribute to the impact of the CPC preschool intervention on subsequent special education placement. Although evidence from this study provides support for the cognitive advantage hypothesis, it did not support the role of family support as measured by parent participation in school. These findings are discussed in greater depth.

Cognitive advantage hypothesis

Evidence from this study suggests that the long-term effects of the program can primarily be understood by the strong mediating impact of ITBS cognitive scores at kindergarten entry. This finding provides support for the cognitive advantage hypothesis that has also been supported by studies of other model early intervention programs (Berrueta-Clement, Schweinhart, Barnett, Epstein, & Weikart, 1984; Schweinhart et al., 1993) and by previous reports in the Chicago study of mediators leading to school achievement (Reynolds et al., 1996; Reynolds, 2000). Clearly, the CPC preschool intervention provided a cognitive boost (as measured by significantly higher ITBS scores upon entry into kindergarten) and the CPC intervention group had significantly lower rates of placement in special education during the first grade. As was mentioned above, the children's initial improved performance on the ITBS may have reduced the risk for low parental and teacher expectations and negative school tracking upon entry into the elementary grades. While the cognitive advantage hypothesis was a primary initiator of the reduction in special education, the paths of influence are no doubt complex and should be investigated more fully in future studies.

Given the direct impact of the CPC preschool intervention on reducing the rates of special education among students with specific learning disabilities, the cognitive advantage hypothesis may have particular importance for understanding the role of early intervention on students with specific learning disabilities. Although there is limited understanding of the determinants of learning disability, about 80% of learning disabilities are attributed to reading difficulties (Lerner, 1989; Kavale, 1984). One longitudinal study identified reading disabilities as a persistent deficit, with 74% of individuals diagnosed in third grade continuing to have difficulty in ninth grade (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1994). Lyon (1996) suggests that this lack of improvement may be attributed to lack of motivation and loss of self-concept related to the earlier experience of failure. Some research indicates that early intervention with specific reading skills could help to reduce or prevent these disabilities (Tangel & Blachman, 1992). However, because a diagnosis of learning disability requires identifying a discrepancy between academic achievement and ability to learn (Lyon, 1996), many students with these disabilities are not diagnosed (and receive no intervention) until the third grade, after significant delays have been documented. This delayed approach to intervention is in direct conflict with the theory of early intervention. Rather than experiencing a cognitive boost leading to a positive cycle of confidence and increased motivation, students with learning disabilities must first experience failure and fall behind their peers before they become eligible for intervention. As such, they are at risk of being trapped in a negative cycle of failure that may prolong their need for special education services. Since many early intervention programs, including the CPC preschool intervention, emphasize literacy skills as part of the general curricula, it is quite possible that the improved ITBS scores facilitate the development of reading skills and reduces the level of disability and motivation associated with ongoing failure. However, the specific aspects of how this outcome is achieved need further investigation.

Family support hypothesis

Given that family involvement is a major component of the CPC preschool program intervention it is somewhat surprising that our study provides no support for this hypothesis even though parent involvement was directly associated with lower rates of special education placement. It is important to note that absence of family support mediation could be influenced by the fact that our measure of family support, teacher and parent ratings of school involvement is a less comprehensive indicator than that used to measure cognitive advantage. Thus, we may have underestimated the effects of the family support hypothesis in explaining the effects of preschool participation. Of particular note, our measure of family involvement only captures levels of family involvement

in school, not in the home environment. Thus, this measure would not reflect the degree to which parents spend time at home reading with their children, which may be critical for understanding the outcomes of this study. Nevertheless, family involvement in children's school to enhance family-school partnerships is the major emphasis of the parent program and has been shown in prior studies to mediate the effects of program participation on reading and math achievement (Reynolds, 2000; Reynolds et al., 1996). This mediation appears not to extend to special education placement. Future studies would benefit, however, from the investigation of additional measures of family involvement, such as the home environment and parent expectations, to more comprehensively test the viability of this hypothesis to understanding the impact of preschool intervention on special education. Previous studies are not encouraging, however, since program participation had generally lower correlations with measures of home support than with school participation (Reynolds, 2000). Although it is interesting to note that CPC preschool participants were more likely to have parents who participated in school activities in the early elementary grades, the only conclusion that this study can draw is that it does not appear that parent involvement in school activities alone provides an explanation for the benefits of preschool interventions with respect to special education services.

Potential Limitations and Alternative Explanations

Because of the quasi-experimental design of the study, it remains possible that unmeasured factors could have contributed to our findings. Thus, our results should be interpreted with caution. However, considering the variability in the quality of research on the long-term impact of large-scale early intervention programs (Barnett, 1995), this study addresses an important gap in the literature. The two most common critiques of the quality of large-scale public early intervention research design relate to formation of the comparison groups and high attrition. When research participants are not randomly assigned to the intervention and comparison groups, there is increased risk that the estimated effects of the intervention may be due to preexisting difference between the experimental and comparison groups rather than to the impact of the intervention itself (Barnett, 1995; Reynolds & Temple, 1995). Large-scale intervention studies vary in their efforts to reduce the risk that program effects can be attributed to pre-existing group differences, which impact on their overall quality. Two indicators can help distinguish the quality of large-scale interventions utilizing a quasi-experimental design. One is the effort made to ensure the groups are closely matched with minimal selection bias and the second is to statistically control for any initial differences in the key characteristics of the groups.

Although children were not randomly assigned to treatment groups, great care was devoted to the recruitment efforts and statistical analyses to reduce any impact of self-selection or pre-existing differences between the groups. First, a school-community representative in each CPC canvassed the neighborhood to seek participation and made extensive efforts to enroll children with the greatest levels of educational need. The reason that most children in the comparison group did not enroll in the program was because they did not live in the attendance area of the CPCs and there was nearly complete saturation in program participation occurred. To ensure close matching of the comparison and intervention groups, the comparison group was randomly selected from Chicago public schools that matched the school characteristics of the intervention group (e.g., eligibility for government funded early childhood programs, participation in early childhood programs, and school neighborhood poverty). Third, because the CPC preschool intervention group is compared to some children (15.4%) who also received a Head Start preschool intervention, findings reflect the added value of these additional services. This introduces a conservative bias since in most studies the comparison group receives no intervention at all. Finally, we included a set of covariates in the statistical model to account for the measured differences between groups including the family risk index and participation in later school-age intervention. Although these efforts cannot ensure that we matched or controlled for all of the key characteristics (Barnett, 1995), they do speak to the overall quality of this research design relative to other large scale public intervention studies and increase our confidence that the differences between the groups provide good estimates of the intervention effects. Furthermore, previous studies on selection bias in the Chicago Longitudinal Study show no evidence of bias for

child outcomes (e.g., school readiness, reading and math achievement, grade retention, and special education) as assessed by simultaneous-equation and latent variable models (Reynolds & Temple, 1995, 1998; Temple, Reynolds, & Miedel, 2000).

The second major threat to the quality of large-scale public research studies is high attrition. High attrition reduces the confidence that the current sample is comparable with the original sample and that the current intervention and comparison groups are comparable to each other. The attrition level of this study was low (10.5%), and no differential or selective attrition was found between the study sample and the original sample.

Areas for Further Research

Whereas cognitive readiness explained a substantial portion of the link between preschool participation and need for special education services, a significant amount of variance was unaccounted for. This suggests that the CPC program may offer other benefits that also contribute to a reduction in subsequent special education. One potential variable that could help to further explain the group differences could be level of student motivation to learn. The motivation that is generated by early success with learning may help to foster a child's confidence and ability to remain motivated to continue to learn more and more over time. This motivational advantage hypothesis should be investigated further. Another factor that may contribute to the children's success could be as basic as the benefits of daily meals and early medical screening. These health benefits contribute to the conditions under which learning occurs. Moreover, characteristics of the preschool environment may contribute to the transmission of long-term effects (Frede, 1996). The quality of elementary schools may also help maintain or enhance the impact of early intervention (Lee & Loeb, 1995; Currie & Thomas, 2000).

Given the high prevalence rate of learning disability, the fastest growing proportion of special education students (Lewit & Baker, 1996), more information is needed regarding the specific impact that early intervention programs have on students with learning disabilities. Although this study provides evidence that the CPC preschool intervention had an impact on reducing the need for learning disability services, the micro mechanisms that produce this outcome needs to be clarified. Do certain learning activities or curricula contribute to these reductions in learning disabilities or are they due to the total package of intervention services? Or are reductions in learning disabilities due to specific reading skills or to general cognitive skills? Judging from the accumulated literature on early intervention (Barnett, 1995; Consortium for Longitudinal Studies, 1983; Schweinhart et al., 1993), support is greater for the link between preschool participation and improvement in general cognitive skills.

It is important to note that use of the ITBS scores is only one measure of cognitive readiness and as with all measures it is limited in the degree that it can fully represent the all aspects of cognitive readiness. Future research should include additional measures of cognitive readiness to further explore the relationship between cognitive advantage and special education placement. Given the overall lower participation of African American parent involvement in special education planning and services (Lynch & Stein, 1987; Cassidy, 1988; Lowry, 1983; Sullivan, 1980), it is important to better understand how early intervention programs engage parents and what leads to continued parental involvement over time. With this in mind, future research should include a more in-depth analysis of parent involvement, utilizing multiple methods of assessment over the course of the child's participation in elementary school and beyond. Investigations of other hypotheses of mediation also are warranted, including the contribution of post-program school quality and social-psychological factors (Currie & Thomas, 2000; Reynolds, 2000). These and other potentially important variables should be explored in future research so that educators and program designers can use this information in deciding what to emphasize most during intervention planning and implementation.

Notes

[1] To be consistent with the accumulated research, we emphasized the contrast between any CPC preschool participation and nonparticipation. A slight majority of the CPC group enrolled for two years of preschool (see Table 2). Overall, unadjusted cumulative rates of special education placement were similar between two-year and one-year groups (11.6% vs. 14.8%; $p = .166$) as was the mean number of years of special education (0.43 vs. 0.50; $p = .421$). The lone significant difference was for incidence of placement for emotional or behavioral disorder (1.9% vs. 4.4%; $p = .032$), in favor

of the two-year group (see Reynolds, 1995, for other comparisons).

[2] For example, group differences (in favor of the preschool participants) were 8 percentage points when 20 site-level dummy variables were added, 7 points when single-parent status and unemployment were added, and 7 points when preprogram child abuse and neglect as well as grade retention were added. Nevertheless, grade retention was an independent predictor of the incidence of special education placement ($b = .11$, $p < .01$). A similar pattern of findings occurred for years of special education placement.

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