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Age-26 Cost-Benefit Analysis of the Child-Parent Center Early Education Program

Arthur J. Reynolds[1], **Judy A. Temple**[1], **Barry A. White**[1], **Suh-Ruu Ou**[1], and **Dylan L. Robertson**[2]

[1]University of Minnesota

[2]Chicago Public Schools

Abstract

We conducted a cost-benefit analysis of the Child-Parent Center (CPC) early childhood intervention. Using data collected up to age 26 on health and well-being, the study is the first adult economic analysis of a sustained large-scale and publicly-funded intervention. As part of the Chicago Longitudinal Study, a complete cohort of 900 low-income children who enrolled in 20 CPCs beginning at age 3 were compared to 500 well-matched low-income children who participated in the usual educational interventions for the economically disadvantaged in Chicago schools. School-age services were provided up to age 9 (third grade). Findings indicated that the three components of CPC had economic benefits in 2007 dollars that exceeded costs. The preschool program provided a total return to society of $10.83 per dollar invested (net benefits per participant of $83,708). Benefits to the public (other than program participants and families) were $7.20 per dollar invested. The primary sources of benefits were increased earnings and tax revenues, averted criminal justice system and victim costs, and savings for child welfare, special education, and grade retention. The school-age program had a societal return of $3.97 per dollar invested and a $2.11 public return. The extended intervention program (4 to 6 years of participation) had a societal return of $8.24 and public return of $5.21. Estimates were robust across a wide range of discount rates and alternative assumptions, and were consistent with the results of Monte Carlo simulations. Males, 1-year preschool participants, and children from higher risk families had greater economic benefits. Findings provide strong evidence that sustained early childhood programs can contribute to well-being for individuals and society.

The cost-effectiveness of prevention programs is an increasingly important guide for identifying interventions most worthy of dissemination and sustainability. Given their identified long-term positive effects, early childhood interventions are widely considered to be one of the best and most cost-effective childhood investments (Committee on Economic Development, 2002; Karoly et al., 2005; O'Connell, Boat, & Warner, 2009; Reynolds & Temple, 2007).

Although early interventions have been investigated for economic benefits more than other interventions, the supporting evidence is limited in three major respects. First, few studies have been conducted on established programs administered by schools and other public agencies. This limits the extent to which current knowledge generalizes to larger-scale and sustained programs. Second, much of the evidence has emphasized projected over actual benefits, which increases concern about the reliability and stability of findings. In cost-benefit analyses (CBA) of specific programs, cohorts of program and control groups are

Please direct correspondence to: Arthur J. Reynolds, Institute of Child Development, 51 East River Road, Minneapolis, MN 55455 or ajr@umn.edu.

typically followed into adulthood when the most economically-significant outcomes are known such as educational attainment, occupational status, and social adaptation. Finally, the variability of economic benefits by sample and program characteristics has not been a focus of research. The cost-effectiveness of timing and duration of intervention is particularly relevant for policy.

In this study, we conduct a cost-benefit analysis of the Child-Parent Center (CPC) Program using outcome data by age 26. As an established, government-funded early educational intervention in the Chicago public schools for over 4 decades, CPCs provide preschool and school-age services up to age 9 for economically disadvantaged children. Not only is this the first adulthood CBA of a sustained publicly funded early childhood intervention, but one of the very few studies in which the differential impacts of timing and duration are assessed.

Contributions to Promoting Healthy Development

The CBA framework, in which the impacts of interventions are estimated in dollars, enhances the policy use of research for promoting health and well-being in three significant ways. First, an emphasis on economic benefits addresses the contributions of interventions to society while accounting for costs. This focus on efficiency is a major departure from traditional measures of effect size such as SD units, which ignore program costs. CBA produces a measure of effectiveness that is more practical for administrators and policymakers. CBA can thus facilitate use of research findings for program and policy improvement (Farrington & Welsh, 2007; O'Connell et al., 2009). Net economic benefits or "returns" can be defined at different levels including societal, general public, governmental, or individual.

Another contribution of CBA to promoting health and well-being is its facilitation of comparative analyses of alternative programs. Given limited availability of funding for social programs, interventions with the largest "return on investment" can be identified and attached some priority. Unlike the traditional effect size approach, in CBA, impacts across multiple outcomes can be converted to dollar units and summed to estimate total benefits. Although cost-effectiveness is largely ignored as a criterion for identifying effective programs in the growing registries field, CBA can contribute to improving this state of affairs while encouraging critical analysis of alternative investments for dissemination and use.

CBA's third contribution to promoting health and well-being is through its enhancing the understanding of the impact of interventions and policies. CBA typically requires longitudinal data on multiple indicators of well-being that have social significance. Benefits for different indicators such as crime and income can be estimated together. Such assessments are rare in prevention research (Durlak, 1997; O'Connell et al., 2009; Reynolds & Temple, 2008). The centrality of the life-course perspective in CBA often leads to a more complete understanding of effects. In conducting the study, causal explanation becomes critical. How does the intervention attain these benefits?

Previous CBA Findings for Early Childhood Interventions

The most extensive evidence on cost-effectiveness comes from the High/Scope Perry Preschool Program (Schweinhart et al., 1993, 2005). Beginning in 1962 with a sequential cohort of 123 three- and four-year-old low-income black children, experimentally-assigned program enrollment was associated with improvements in cognitive skills, school achievement and performance, economic status, and with reductions in criminality (Weikart & Schweinhart, 1980; Schweinhart et al., 1993). Program researchers conducted CBAs at ages 19 (Berreuta-Clement et al., 1984), 27 (Barnett, 1996; Schweinhart et al., 1993), and 40

(Belfield et al., 2006; Schweinhart et al., 2005). Findings showed that total economic benefits of the program substantially exceed program costs, which in 2007 dollars averaged $18,261 per child. At the age 27 follow-up, for example, the ratio of benefits to costs was $8.74 per $1 invested. Most of the benefits were due to increased earnings and crime savings. Roughly two-thirds of the total benefits came from criminal treatment and victim savings. Economic benefits increased over time from a return of $6.87 per dollar invested at age 19 to $17.07 per dollar invested at age 40 (see also Heckman et al., in press).

Although findings are suggestive of the high cost-effectiveness for preschool programs for 3- and 4-year-olds, studies of different programs of different scales are needed. Being a model program, the Perry findings may have limited generalizability to current established, sustained programs. Some program features of Perry were atypical of contemporary programs, including four master's level teachers for each class, weekly home visits, and a high child-initiated curriculum approach. It did not become routinely implemented in public schools.

Research syntheses and policy analyses of contemporary state/local preschool investments that rely on relatively modest assumptions of future benefits and cost savings also suggest positive benefits. Economic returns exceed costs by a minimum factor of 2 (Aos et al., 2004; Lynch, 2007). School-age programs such as small classes or social skills training generally show lower cost-effectiveness than preschool programs (see Reynolds & Temple, 2008).

Interventions begun prenatally or by age 3 also show evidence of positive economic benefits. The prenatal and infancy nutrition program Woman, Infants and Children (WIC) has been reported to save $3.07 per dollar in reduced medical costs in the first year of life due to reduced rates of low birth weight births (Avruch & Cackley, 1995). The more comprehensive Nurse-Family Partnership, an intensive home visiting program from prenatal to age 2, found returns of over $5 per dollar invested for the highest risk families (Karoly et al., 1998; see also Aos et al., 2006). This was primarily due to the mother's increased economic well-being and lower crime by mothers and children. The Carolina Abecedarian Project, a university center-based education and care program from birth to age 5, showed benefits of $2–$4 (Masse & Barnett, 2005). Assessed at age 21, the main benefits were increased earnings for the mothers, increased life expectancy associated with lower rates of tobacco use, and remedial education savings.

Like the Perry preschool, the Abecedarian Project was a demonstration program that has limited generalizability to current practice. Limiting factors were its high cost ($73,159 per child), implementation in a university setting, and small group sizes (12 at ages 3 and 4). Of these prenatal and infancy studies, only WIC is a publicly funded, sustained intervention within existing service systems. However, as a low-cost nutrition program ($393 per child in $2007), WIC would not be expected to have the broad long-term effects of center-based child development programs.

Previous Findings in the Chicago Longitudinal Study

In the first cost-benefit analysis of an established, publicly-funded preschool program,Reynolds et al. (2002) found that, on the basis of accumulated evidence at the end of adolescence (Reynolds, 2000; Reynolds et al., 2001), CPC participation was associated at ages 20–21 with economic benefits that exceed costs. CPC preschool demonstrated the greatest social benefits--$7.14 to $10.15 per dollar invested, as measured by increased life time economic well-being, lower delinquency and crime, and reduced need for remedial education and child welfare services. School-age participation was associated with benefits of $1.66 to $2.02 per dollar invested. Relative to lesser services, extended intervention for 4 to 6 years had benefits of $6.85 to $9.54 per dollar invested. Males experienced higher

economic returns from preschool than females. One-year preschool participants had higher returns per dollar invested than 2-year participants. Females experienced higher returns from school-age intervention than males. These findings were further supported by earlier studies documenting impacts on school performance and attainment and crime prevention (Reynolds, 2000; Reynolds & Temple, 1995, 1998; Reynolds & Robertson, 2003).

One limitation of the initial CBA was that estimates for earnings and adult crime prevention relied on projections from educational attainment by age 20 and juvenile crime rather than on observed adult outcomes. While benefits were sizeable for a range of discount rates and earnings and crime projections, a CBA that incorporates observed adult outcomes would be valuable. Second, the earlier study did not include benefits on health and well-being, including substance use and related health-compromising behaviors, mental health, public aid receipt, and utilization of health care services. Hence the economic benefits may have been underestimated. At the age 24 study of program effects, Reynolds et al. (2007) found that program participation beginning in preschool was associated with higher rates of educational attainment and health insurance coverage, and with lower rates of depressive symptoms, felony arrest, incarceration, and lower rates of out-of-home placement in the child welfare system. A third limitation was incomplete measurement of some outcomes. Educational attainment was assessed at age 20 before postsecondary education enrollment was known for many individuals. No data were available on out-of-home placement in the child welfare system. A final limitation of the previous study is that it did not examine how benefits varied by the extent of the family's socio-economic disadvantage.

Present Study

To address the limited scope and age-span of the previous study and advance translational research on cost-effectiveness, we conducted an age-26 CBA of the CPC program using data from the Chicago Longitudinal Study. Three major questions were addressed: (1) Does participation in the CPC program continue to demonstrate high economic benefits relative to costs? (2) Do the estimated economic benefits in 2007 dollars differ across preschool, school-age and extended-program participation? (3) Do economic benefits differ by child and family subgroups, including gender, family risk status, and length of preschool participation? Main effects of CPC on key outcomes were reported as part of these analyses.

Given our earlier findings, we hypothesized that the societal and public benefits of CPC would exceed costs and that the benefits of preschool participation would be greater than school-age participation as well as extended participation. We also expected that benefits for males would be greater than for female participants, and that benefits would be greater for those at higher risk of school failure.

Funded by Title I of the Elementary and Secondary Education Act of 1965, CPC is after Head Start the nation's oldest federally-funded preschool program. Established in 1967, the program has provided comprehensive child and family services from ages 3 to 9 in 25 schools in high-poverty neighborhoods. The CLS follows a complete cohort of 989 CPC participants along with a comparison group of 550 children from randomly selected schools participating in the usual early intervention. Approximately 90% of each group has been followed to age 26.

METHOD

Sample and Design

The Chicago Longitudinal Study (CLS, 2005) is a prospective investigation of the life course of a cohort of 1,539 children (93% black, 7% Hispanic) from low-income families

born in 1979–1980 who attended early childhood programs in 1985–1986 in 25 sites. The original sample included the complete cohort of 989 children who completed preschool and kindergarten in all 20 CPCs with combined programs and 550 low-income children who did not attend the program in preschool but instead participated in a full-day kindergarten intervention program in five randomly selected schools and in schools affiliated with the CPCs. 15% of the comparison group attended Head Start preschool with the remaining children in home care. Thus, the comparison group enrolled in the usual early childhood interventions available for low-income children. School-age services are provided in first to third grades in affiliated schools regardless of children's preschool or kindergarten participation.

In this alternative-intervention, quasi-experimental design, the comparison group matched the program group on age, eligibility and participation in intervention, and neighborhood and family poverty. Eligibility criteria for the program are (a) residence in a Title I attendance area, (b) demonstration of high educational need due to poverty-associated factors, and © parents agree to participate. That the program was a sustained intervention with positive evidence of effectiveness and was dedicated to serve those most in need prevented random assignment to program groups.

Following previous studies (Reynolds et al., 2001, 2007), the impact of CPC preschool was estimated by comparing the performance of the preschool group who enrolled at ages 3 or 4 against all other participants in the study who attended the usual early childhood programs in preschool or kindergarten. The impact of the school-age program was assessed by comparing those participating in the school-age program for one or more years with participants who did not regardless of preschool participation. The effects of preschool and school-age participation were assessed simultaneously. The effects of extended intervention (preschool plus school-age) were assessed by comparing participants who enrolled in the CPCs in preschool and continued their participation through second or third grade (4 to 6 total years) to all others with less extensive participation (1 to 3 years).

Since 1985, data have been collected prospectively as well as from birth records, participant and family surveys, administrative data on school performance and well-being from school records and administrative records up to age 26. The patterns of participation and postprogram data collection are shown in Table 1 (see Appendix A for details). Over 1,400 participants had data for one or more of the young adult outcomes. Educational attainment was known for 91% of the original program group and 87% of the comparison group with no evidence of selective attrition (Reynolds et al., 2007). Rates of sample recovery were even higher for the outcomes of adult crime and child maltreatment. Across different outcomes, participants in the attrition and study samples were equivalent on family background.

Four study features make comparisons interpretable as program effects. First, the comparison group was chosen from randomly selected schools participating in full-day kindergarten and other school services, which was "treatment as usual" while 15% of the comparison group had Head Start preschool. This contrasts results in a conservative bias compared with many previous studies. Second, more than 80% of children in the neighborhoods of the centers participated in the program, suggesting that program enrollees are representative of the center neighborhoods. Because CPCs were located in the highest poverty areas of the city that had no other preschool programs further indicates saturation of program coverage and the greater economic disadvantage of the CPC neighborhoods. Third, the pattern of effects over time is largely explained by mechanisms central to the intervention theory, including the enhancement of cognitive and literacy skills, family support behaviors, and the quality of later school environments (Reynolds, 2000; Reynolds,

Ou, & Topitzes, 2004). These findings are part of the confirmatory approach for strengthening validity (Reynolds, 2005). Finally, results from a wide range of analyses using latent-variable modeling, econometric methods, propensity scores, and alternative comparison groups have consistently indicated that program estimates are robust (Arteaga, Reynolds, & Reynolds, 2008; Reynolds, 2000; Reynolds & Temple, 1995; Reynolds et al., 2001, 2007).

Group Comparability

Table 2 shows the characteristics of the program and comparison groups at the age 26 follow up. The follow-up sample was based on the 1,372 participants with known educational attainment by August 31, 2005 (average age of 25.5 years). Child and family characteristics were measured from administrative records (birth records, public aid receipt) and family surveys assessing preprogram characteristics from birth to age 3. The p-values show the significance of the group differences at follow-up and at the beginning of the study (original sample).

At follow up, program and comparison groups were similar on most attributes including low birth weight, race, child welfare history, single-parent status, mother's employment, financial problems, family conflict, and economic disadvantage (i.e., TANF receipt and eligibility for subsidized meals). These similarities are reflected in the risk index, the sum of eight dichotomous family risk indicators. Each group experienced an average of 4.3 risk factors early in life. At the age 26 follow-up, the program group had a higher proportion of females, a higher proportion of parents who completed high school, and a higher rate of enrollment in high-poverty schools. The latter difference is the result of the centers being located in the most economically disadvantaged school areas. Estimates of intervention effects take account of observable background differences between groups.

Group comparisons of preprogram characteristics for the original sample and follow-up sample show similar equivalence on background characteristics (see also Reynolds et al., 2001, 2007). Comparisons using the school-age and extended intervention groups as well as other adult outcomes (e.g., crime records, employment) showed a pattern similar to Table 2. The extended intervention group, for example, was equivalent to the nonextended group on single-parent status (76% vs 76%), no employment (65% vs 67%), child welfare services (3% vs 4%), eligibility for subsidized meals (83% vs 84%), school-level poverty (77% vs 75%), the risk index (means of 4.3 risks) and home environment problems (55% vs 55%), respectively. Many previous studies also have found that the influence of unmeasured variables is small (Reynolds & Temple, 1995; Reynolds, 2000; Temple & Reynolds, 2009).

Child-Parent Center Program

Since the program is described fully in previous reports (Reynolds, 2000; Reynolds et al., 2001, 2007), we provide a summary of the main features. Located in or close to public elementary schools, the CPCs provides child education and family-support services to children between the ages of 3 and 9 (preschool to second or third grade; see Appendix B). Within a structure of comprehensive services, the intervention emphasizes the acquisition of basic skills in language arts and math through relatively structured but diverse learning experiences that include teacher-directed, whole-class instruction, small-group activities, and frequent field trips. Literacy experiences involving word analysis, oral communication, and listening skills are highlighted as described in the instructional activity guide (Chicago Board of Education, 1988). While learning activities are generally consistent with contemporary practice, the CPCs, in contrast to many other programs, have emphasized literacy and numeracy since they opened (Reynolds, 2000; Sullivan, 1971).

At the time of the study sample's participation, each of the 24 centers served approximately 100 to 150 children aged 3 to 5 years. The centers are located in the poorest neighborhoods in Chicago. The mean rate of family poverty in 1989 for the community areas serving the CPCs was 41 percent versus 17 percent for other areas. Each center is directed by a head teacher and two coordinators. The parent-resource teacher coordinates the family-support component. The school-community representative provides outreach to families. All of the teachers have bachelor's degrees and are certified in early childhood. The program was located in areas not being served by other preschool programs.

The preschool program runs 3 hours per day, 5 days per week during the 9-month school year, and usually includes a 6-week summer program. After full-day or part-day kindergarten, continuing services are provided in the affiliated schools under the direction of the curriculum parent-resource teacher. Major elements of the preschool program include:

- -- structured set of educational activities emphasizing reading and math skills, and complemented with other instructional materials (e.g., Language Lotto, Alpha Time, and Peabody Language Development Kits;
- -- child-to-staff ratios of 17 to 2 (certified teacher and aide)
- -- an intensive parent program that includes participating in parent room activities
- -- volunteering in the classroom, attending school events, training, and field trips
- -- outreach activities including resource mobilization and home visitation, and
- -- health screening, speech therapy, and nursing and meal services.

CBA Conceptualization and Methods

As a public investment in children and families, the CPC program is expected to enhance many indicators of well-being that are instrumental to long-term benefits. These include school performance and attainment, social-emotional functioning, health behaviors, and economic self-sufficiency. Based on ecological (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 1998) and human capital theories (Becker, 1964; Heckman, 2000) of life-course development, the economic benefits of CPC would be expected to be relatively large. Educational enrichment is early in the life course. It begins prior to formal schooling and consequently promotes smooth transitions to K-12 education. The amount or dosage of intervention is high. The preschool education component is 540 hours per year. Services are intensive with small classes and low child to staff ratios, and an emphasis on literacy. Comprehensive services to parents also are provided as well as health and nutrition education. Consequently, the dosage and scope of services for CPC is greater than for most other preventive interventions.

Following standard economic procedures (Levin & McEwan, 2001), we estimated the present value of program benefits in 2007 dollars for seven main categories: (a) reductions in expenditures for K-12 remedial education, including special education and additional schooling for retained students, (b) reductions in criminal justice system expenditures for juvenile and adult arrest and treatment, © reductions in child welfare system expenditures associated with maltreatment, (d) averted tangible and intangible expenditures to crime victims as a result of lower rates of arrest and to victims of child maltreatment, (e) reductions in expenditures for mental health and substance abuse treatment associated with depressive symptoms and substance misuse, and (f) increases in projected earnings and tax revenues as a result of higher educational attainment. We also monetized the CPC estimates for daily tobacco use. However, because of the uncertainty of costs associated with use, the estimated benefit assessed by reduced mortality is included only in the sensitivity analysis.

We did not include direct program benefits for public aid receipt and health insurance coverage. In addition, benefits realized by the parents of participants and future generations are excluded. Net savings associated with lower rates of public aid are usually small and are restricted to administrative costs. Most measures of public aid are similar for program and comparison groups. Although health insurance coverage is associated with many benefits to individuals and society, its value would be expected to overlap other benefits for which educational attainment is a strong correlate such as compensation, criminal justice savings, and substance abuse treatment. Since health insurance coverage is included in fringe benefits from employment, earnings estimates account for insurance indirectly.

Consistent with the previous study, the main steps in calculating costs and benefits of CPC participation were as follows: (a) program costs and benefits are calculated in dollar terms, (b) dollar values are converted to 2007 dollars to adjust for inflation, © the present values of future costs and benefits are computed by applying a 3% annual discount rate to age 3 for all levels of participation, and (d) the present value of program costs is subtracted from the present value of program benefits to obtain the net present value of the program per participant. Alternatively, program benefits are divided by costs to obtain the dollar return for every 1 dollar invested (benefit-cost ratio). Because it is common to estimate lifetime earnings from educational attainment, future earnings were project through age 65 (Aos et al., 2004; Barnett, 1996; Karoly et al., 1998). Alternative discount rates were tested as part of sensitivity analysis. See Appendix C for the itemized breakdown of benefit and cost categories.

We distinguish three types of benefits in the analysis. Benefits to participants are for the child and parent attending the program. These include increased earnings capacity over the life course and the value to parents for the provision of part-day preschool. Benefits to the general public include averted expenditures for remedial education and child welfare spending by governments, reduced tangible and intangible expenditures to crime victims, reduced expenditures for mental health and substance abuse treatment, and increased tax revenues to governments associated with increased earnings. Finally, benefits to society are the sum of benefits to program participants and the general public, including government savings. We emphasize benefits to the general public and to society.

Program Costs

Based on the estimation procedure in the age 21 analysis (Reynolds et al., 2001; Reynolds, Reynolds & White, 2007), the per-participant cost of the CPC program were reported in 2007 dollars for the preschool, school-age, and the extended components. These taxpayer costs include all outlays for staff, family and community support, administration, operations and maintenance, instructional materials, transportation and community services, school-wide services, school district support, capital depreciation and interest, and parent opportunity costs (see Table 3, Reynolds et al., 2001). Estimates were derived from operational budgets of the Chicago Public Schools in 1985–86 (preschool; Chicago Public Schools, 1986a) and 1986–1987 (school-age; Chicago Public Schools, 1986b).

Preschool—The present-value (adjusted for inflation and discounted to age 3) average cost per participant of the preschool program was $8,512. This cost is based on an average length of participation of 1.55 years. The average cost per child of 1 year of preschool was $5,597. Instructional staff for the classroom, parent program, and administration accounted for 65.7% of the total program expenditures.

School-age—The present-value average cost per participant was $3,792. The average length of participation was 2.14 years. The cost of one year of the school-age program was

$2,010 per child above and beyond regular instruction. The largest category for the school-age program was instructional staff. 87.7% of expenditures were for teachers and aides for the reduction of class sizes and child-to-staff ratios.

Extended program **(preschool plus school-age)—**The corresponding average cost per participant for 4 to 6 years of enrollment was $12,719. The average length of enrollment was 3.87 years. The net cost per participant, above and beyond less extensive participation (1 to 4 years), was $5,163 ($12,719 minus $7,556). The average cost of the total program, excluding kindergarten, was $12,304 per participant.

Because the effects of kindergarten were not assessed, we did not include the costs for the half-day or full-day CPC kindergarten program. Moreover, the comparison group participated in all-day kindergarten that approximated or exceeded that for CPC kindergarten (Chicago Board of Education, 1984). The focus of the analysis is CPC-specific costs.

Program Benefits

For consistency and interpretability between studies, we followed as much as possible the previous estimation procedures. Some categories (adult crime, child welfare, lifetime earnings) were updated substantially from the previous analysis. Estimates for mental health and substance abuse savings are new. Below we summarize the benefit categories. For brevity, child care benefits (freed parental time) and college tuition (as a consequence of greater educational attainment) are not included (see Appendix C). All values are reported in 2007 dollars per participant discounted to age 3 with a 3% annual discount rate. See Appendix C for a breakdown of costs and benefits and the monetized standard errors of estimates,Temple et al. (2007) andWhite et al. (2009) for technical appendices, and Reynolds et al. (2001, 2007) further information on data sources and measures.

Reductions in expenditures for school remedial services—Savings in school remedial services are estimated for grade retention and special education placement from kindergarten to grade 12. The assumption is that grade retention increases the cost for a student to complete their education. To be conservative, we assumed that grade retention results in an additional year of school at age 19. The cost is discounted back 16 years to age 3 even though retention was measured through age 15. We used the average per pupil annual expenditure in Chicago for general education as the estimate for this additional year (Illinois State Board of Education, 1997). The estimated present value cost per participant of an additional year of school is $5,716. Expenditures for special education above and beyond regular instruction are the weighted average annual cost per pupil reported by the Chicago Public Schools for four categories of special education: specific learning disabilities, emotional or behavioral disturbances, speech and language impairment, and mental retardation (Chicago Public Schools, 1995). In 2007 dollars, the present value of a year of special education is $7,596.

Increases in lifetime earnings, compensation, and government tax revenues—Increases in lifetime earnings and compensation for ages 18 through 65 are projected from differences in educational attainment between program and comparison groups. High school completion is defined as graduating from a regular high school or earning an equivalent credential (GED) by age 25. To allow for comparison with the previous study, we used Census and Labor Department data on annual earnings by educational attainment from 1999 (Bureau of Census, 2000) for black full-time workers aged 25–29 years to project lifetime earnings for four categories of educational attainment (less than high school, high school completion, some college, and four or more years of college) by gender. Estimates assume a

3% annual discount rate, 2% real income growth rate, and a 43.5% fringe benefits rate as suggested by the Bureau of Labor Statistics (2002). For high school completers, it was assumed that 32% would participate in some college and 10% would complete a 4-year degree. The present value of the after-tax lifetime earnings and compensation difference associated with completing high school is $277,102. We applied a 33.3% tax rate (15% federal tax, 3% state income tax, and 15.3% FICA tax) to lifetime earnings. The present value of lifetime income tax contributions associated with high school completion is $78,996.

Reductions in criminal justice system expenditures for youth and adult crime—Savings associated with the juvenile criminal justice system are equivalent to the age 21 analysis. Estimated criminal justice system expenditures include administrative expenses and the weighted national average of the proportion of juvenile arrests leading to residential treatment, community treatment or probation services, and release (Bureau of Justice Statistics, 1997; Cohen, 1988). A 58% national adjudication rate for juvenile petitions was employed (Stahl et al., 1999). 19% of petitions to juvenile court were expected to lead to residential treatment and 39% to result in community treatment and probation services. Assuming the average juvenile arrest occurred at age 14 years, the present value of a year of expenditures weighted by the disposition of court petition (residential treatment, community treatment and probation services, or release) is $17,414. The estimate does not account for the fact that some youth received treatment for more than one year, which would increase the average expenditures per participant. However, this is offset by other youth receiving treatment for shorter durations.

Reductions in adult criminal justice system expenditures were estimated from official data on adult felony arrests from ages 18 to 26 from county circuit courts, state departments of corrections, and federal prisons. Most of these records were in Illinois and other Midwestern states. We used the estimated cost of an adult criminal career reported by Greenwood, Model, Rydell, & Chiesa, 1996), which assumes a 10% annual decrease in the crime rate. Adjusted for the difference in the real annual discount rate (4% in Greenwood et al. to 3% in our analysis) and discounting to age 3, the present value of the cost of an adult criminal career (ages 19 through 44) is estimated to be $28,077.

Reductions in expenditures to victims of juvenile and adult crime—Consistent with other research (Barnett, 1996; Schweinhart, 2005) we include averted tangible and intangible costs to victims in our calculation of the benefits of reduced juvenile and adult crime. We used national estimates of the amount and proportion of tangible losses to crime victims for violent and property offenses (Barnett, 1996; Karoly, 1998; Miller, Cohen, & Wiersema, 1996). Victim costs are assumed to be 4.5 times criminal justice system expenditures (Greenwood, 2006; Karoly et al., 1998), and 23.3% are assumed to be tangible and 76.7% are assumed to be intangible. The present values of tangible and intangible victim costs associated with juvenile crime are $18,258 and $60,104, respectively. Projected savings to the victims of adult crime are estimated from the present value criminal justice cost of an adult criminal career ($28,077). Based on the estimated victim costs, the present values of tangible and intangible victim costs associated with the average adult criminal career are $29,439 and $96,909, respectively.

Reductions in expenditures for the child welfare system and victimization from child abuse and neglect—The measure of child maltreatment is substantiated reports of abuse and neglect between ages 4 and 17 years. Approximately 70% of substantiated cases receive in-home services with the rest typically placed in foster care (Courtney, 1998). The cost per case of in-home services is reported as $3,676 in 2007 dollars (Courtney, 1998; Larner, Stevenson, & Behrman, 1998). Our cost per case to provide

out-of-home care is based on the weighted average daily expenditure rate for out-of-home placement in Illinois in 2006 as provided by the Illinois Department of Child and Family Services (IDCFS). The IDCFS categorized placements into relative foster care, non-relative and specialized foster care, institutional care, group home care, and independent and transitional living programs. Information on program and comparison group participants placed in out-of-home care between ages 4 to 17 years and the average duration of placement (4 years) was used to estimate the cost of out-of-home care in Illinois. The undiscounted weighted average cost associated with out-of-home placement services for an average of approximately four years is estimated to be $150,415. Including costs of administration and investigation, the present value of the average expenditures for child maltreatment is $41,199.

Victim costs include the tangible and intangible losses associated with child abuse and neglect as reported by the National Institution of Justice (Miller et al., 1996). Costs include medical care, mental health care, police and fire services, and lost productivity of victims and their families such as forgone wages, missed school days, and certain legal expenses. The present value of the average cost associated with child abuse victimization is $7,153. The present value of intangible abuse victim costs including reduced quality of life associated with maltreatment discounted over ages 4 to 44 is $49,384.

Adult depression—Savings associated with depression-related costs were projected from participants' reports at age 22–24 of the frequent presence of one or more depressive symptoms (Derogatis, 1975). Depression and mental health problems are associated with significant economic costs to society (Berto et al., 2000; Greenberg et al., 2003). The savings estimate from reduced reports of depression is based on the average annual cost of indicated depression in the United States in 2000 (Greenberg et al., 2003). The estimate includes direct treatment costs (i.e., inpatient, outpatient, and pharmaceutical costs) and workplace-related costs (i.e., absenteeism and reduced productivity). Suicide-related costs are excluded from this analysis. Assuming that early adult depression in the program and comparison groups occurred at an average age of 22 years, the present value cost per participant for treatment, absenteeism, and reduced productivity is $10,733. The estimate conservatively assumes that depression persists for two years.

Substance misuse—The measure of substance abuse is participants' reports of substance abuse treatment, substance abuse problems, and current use of marijuana or harder drugs at least a few times per week (Reynolds et al., 2007). These reports were supplemented by convictions for drug possession. This latter, more representative measure was the primary indicator. The estimated benefits of reduced substance abuse includes rehabilitation and treatment expenses, workplace productivity, medical costs associated with potential overdose and other drug related illnesses, risk of premature death, and opportunity costs of resources associated with the manufacture and sale of drugs. The estimate is based on the undiscounted cost of drug abuse over the ages 14 to 60 years, reported by Cohen (1998). Criminal justice system costs and victim costs associated with drug related crimes are excluded from the analysis. The sum of the lower bonds of the included estimates reported by Cohen (1998) was divided equally over the 46 year period. Assuming a 3% annual discount rate, the estimated present value of expenditures related to substance abuse over the ages 16 to 44 years is $62,212.

Reduced risk of mortality associated with lower rates of daily smoking—Although not a primary measure, estimated benefits due to reduced rates of daily smoking are based on the mortality costs of smoking for males and females (Viscusi & Hersch 2007). The average present value of mortality costs for smoking is $651,122 (discounted to age 3). It is based on projected mortality costs per pack of cigarettes consumed after age 24 for

males ($1.77 million present value) and females ($649,225), which excludes the costs of illness before death. To avoid double counting with other benefits, the estimated effect was adjusted for educational attainment and substance abuse prior to the calculation of benefits.

Data Analysis

Based on previous reports (Reynolds et al., 2001, 2002, and 2007), we used probit, negative binomial, and linear regression to estimate the marginal effects of CPC participation. Estimated in STATA, marginal effects are the difference between groups in percentage points or levels of performance after adjusting for covariates. The economic benefit was estimated by multiplying the marginal effect by the respective monetary estimate of the outcome. We also calculated 90% confidence intervals for net present values and benefit/cost ratios. The covariates for the models were as follows, and with the exception of public aid receipt and eligibility for subsidized meals, they were measured from birth to age 3: Race/ethnicity, gender, receipt of child welfare services, parent education, single parent family status, teen parenthood, employment, four or more children in family, and school-poverty rate of the kindergarten sites. Indicators for preschool intervention and school age participation were included in one set of regressions, while the effects of extended participation versus less extended were estimated in another set. Estimates were robust across a range of covariate specifications of family risk, adjustments for attrition (Arteaga et al., 2008; Reynolds et al., 2007), and analyses of propensity score, latent variable, and bounding methods (Arteaga et al., 2009; Reynolds et al., 2007, 2009; Temple & Reynolds, 2009).

RESULTS

Summary of Main Effects of CPC

Table 3 summarizes the primary and economically-important effects of CPC participation by program component. For brevity, outcomes included in the economic analysis are emphasized. For results on additional adult outcomes and K-12 school adjustment and achievement, see the technical report (White et al., 2009), Reynolds (2000, 2005), and Reynolds et al., (2001, 2007).

Preschool—Adjusted for the covariates including school-age intervention, CPC participation was consistently associated with young adult well-being, including high school completion and years of education by age 26, occupational prestige, health insurance coverage, and with lower rates of felony arrest and incarceration, substance misuse, and depressive symptoms.

Preschool participants had significantly high rates of high school completion (79.7% vs 72.9%, $p = .01$) and completed more years of education (12.1 vs 11.8, $p = .01$). They had a significantly lower rate of felony arrest (13.3% vs 17.8%, $p = .04$), which is a 25% reduction over the comparison group. This finding is consistent with other measures of involvement in the criminal justice system such as number of felony arrests, incarceration, and conviction (see Table 3 and technical report). Preschool participants also had higher rates of health insurance coverage (76.7% vs. 66.6%, $p < .001$) and lower rates of depressive symptoms as assessed from ages 22–24 (12.8% vs. 17.4%, $p = .057$). This is a 26% reduction over the comparison group. The economic impacts of depression are also sizable (Greenberg et al., 2003). Similarly, reductions in substance misuse and daily smoking were 19–24% over the comparison group. Preschool participants had a lower rate of substance misuse by age 26 (14.3% vs 18.8%, $p = .04$). They also had fewer months receiving food stamps (see also Reynolds et al., 2009 and technical report).

Among K-12 outcomes, preschool was associated with significantly lower rates of grade retention, special education placement, child maltreatment and out-of-home placement, and juvenile arrest. Percentage reductions over the comparison group ranged from a third to one-half. Although not displayed, differences in reading and math achievement also have been found up to ninth grade (see Reynolds, 2000; Reynolds et al., 2002).

School-age—Controlling for preschool participation and other factors, the adult impacts of school-age participation were limited to public aid receipt by age 24. No significant differences were found for educational attainment, criminal behavior, health status, and mental health. Rates of high school completion were slightly higher for the program group (79.1% vs 75.4%, $p = .14$).

Among K-12 outcomes, school-age participation was associated with lower rates of grade retention (23.8% vs 34.3%, $p < .01$) and special education placement (15.4% vs 21.3%, $p = .02$) as well as school achievement and consumer skills (see Reynolds, 2000; Reynolds et al., 2002).

Extended program—Relative to less extensive participation (1–3 years), extended program participation was associated with higher rates of high school completion (82% vs 77.4%, $p = .08$) and more years of education (12.1 vs 11.9), and higher levels occupational prestige. Participation also was associated to a lesser extent with higher rates of health insurance and lower rates of depressive symptoms and arrests for violent offenses. No differences were found for daily smoking and Food Stamps receipt. For findings based on other comparison groups, see Reynolds et al. (2001, 2007).

For K-12 outcomes, program participation was associated with significantly lower rates of grade retention (21.9% vs 32.3%), special education placement (13.5% vs 20.7%), child maltreatment (8.4% vs 14.4%), and juvenile arrests for violence.

Cost-Benefit Estimates

Table 4 shows the present value of costs and benefits in 2007 dollars for the 3 components of CPC. Each value is the average per program participant. We summarize the findings by component. Appendix C provides more details on the calculations. Benefits are either measured by age 26 or projected through adulthood (age 65) on the basis of strongly predicted measures. We distinguish among societal, general public, and individual participant benefits. Figure 1 shows the benefit to cost ratios, the return per $1 invested. 90 percent confidence intervals also were estimated. The overall internal rates of return were 18% for preschool, 10% for school-age, and 18% for extended intervention (see Appendix C)

Preschool—At an average cost of $8,512 per participant, CPC preschool was associated with an average economic return to society of $92,220 (90% CI; $33,387, $149,053). The largest benefit categories were life-course crime savings which included those to victims, which was 46% of the benefits ($42,462). Earnings capacity and tax revenues projected contributed 31% of societal benefits, followed by savings associated child maltreatment (8%), special education (6%), and substance misuse (3%). As a ratio of benefits to costs, CPC was associated with a return of $10.83 per dollar invested in the program (90% CI; $4.15, $17.50). Crime savings were $4.99 per dollar invested, earnings and tax revenues were $3.39, child welfare was $0.86, and special education was $0.62 per dollar invested.

Benefits to the public, which exclude earnings and participant benefits, totaled $61,246. The ratio of public benefits to costs was $7.20 per dollar invested. Crime savings were by far the

largest category, representing 69%. Income tax revenues (10%), special education (9%), and child welfare (5%) also contributed substantial percentages to public returns (see Table 4).

School-age—At an average cost of $3,792 per participant above and beyond regular instruction, CPC school-age intervention was associated with an average economic return to society of $15,064 (90% CI; −$13,878, $44,006). The largest benefit categories were life-course earnings capacity and tax revenues (54%), followed by special education (24%), crime (10%), child maltreatment (8%), and grade retention (4%). No benefits occurred for substance use, depression, or other health indicators. The societal benefit-cost ratio was $3.97 per dollar invested in the program (90% CI; $-3.66, $11.60). Nearly all of this was from earnings and tax revenues, special education, and crime savings.

Public benefits per participant were $8,000, which was a return of $2.11 per dollar invested. About one half of these benefits were due to special education savings, followed by earnings, crime, grade retention and child maltreatment savings.

Extended intervention—Children in extended intervention enrolled in the preschool and school-age program for a total of 4–6 years. The comparison group enrolled for 1–3 years. As shown in Table 4, economic benefits to society per participant averaged $42,520 (90% CI; $549, $85,589). With an average cost of $5,163 per participant, the economic return of extended intervention was $8.24 (90% CI; $0.10, $16.58). As with preschool, the largest benefit categories were crime savings (36%), earnings and tax revenues (33%), child welfare (14%), special education (12%), and child care (4%).

Average public benefits per participant were $26,884 or $5.21 returned for every dollar invested. Crime savings was the largest category (57%), then special education (19%), tax revenues (11%), and child welfare (9%). Grade retention and depression had smaller benefits.

Benefits for Child and Family Subgroups

The above findings showed relatively high returns for preschool and extended intervention. We also estimated economic benefits for several child and family subgroups. Table 5 displays the net present values and societal return per dollar invested. The estimation procedure was the same as for the total sample but the effect sizes were based on the respective subgroup.

Length of participation—The societal return for 1 year of preschool was higher than for two years ($13.58 vs. $8.54 per dollar invested). While both are relatively high, this indicates that the added cost of the second year provides positive but comparatively lower lifetime returns. These findings are consistent with the age 21 analysis. The main explanation is rates of high school completion and delinquency and crime are equivalent for 1- and 2-year participants, although 2-year participants have significantly lower rates of special education and child maltreatment. Although school-age intervention followed a similar pattern to preschool, extended intervention for 4 years had nearly the same societal return as 5 to 6 years, although the return per dollar invested was slightly higher for the latter group ($9.32 vs. $7.93).

Gender—Although there were differential economic returns, they varied by program component. Male preschool participants had a comparatively higher return than females ($17.88 vs. $2.67). The main sources of this difference were the greater effects for males on educational attainment and crime prevention. For example, 75% of male preschool participants completed high school compared to 58% for comparison counterparts. Public

returns, exclusive of earnings, showed a similar pattern ($10.02 vs. $1.44). The pattern was similar for extended intervention ($11.97 vs. $3.66). In contrast, females derived greater economic returns from the school-age program ($8.42 vs $0.76). This resulted largely from the female participants' higher rates of school completion.

High family risk status—Children with 4 or more family risk factors (e.g., low parent education, single parent family status; low income) had greater benefits from preschool than those with fewer family risk factors ($12.81 vs. $7.21). Public returns yielded a larger discrepancy favoring the high risk group. Most of the differences came from educational attainment and child abuse and neglect. Children from high-risk families also benefited more from extended intervention and from the school-age intervention.

Parent education—Consistent with the compensatory hypothesis, preschool participants whose parents were school dropouts had a higher economic returns than those whose parents were high school graduates ($15.88 vs. $5.33 per dollar invested). Public economic returns also favored the higher risk group, but to a lesser extent ($10.43 vs. $3.33). The key sources of these differences were earnings and crime savings. For school-age and extended intervention, economic benefits were generally similar.

High poverty neighborhood

Children from the highest poverty neighborhoods (60% or more of children residing in low-income families) had returns for the preschool ($17.92 vs. $4.05) and school-age programs ($7.84 vs. $1.22) that were 4 to 10 times higher than children residing in less disadvantaged areas. These differences were largely accounted for by educational attainment and crime prevention. For the extended intervention, returns were slightly higher for children in the poorest neighborhoods.

Sensitivity Analysis

We tested the robustness of economic benefits for different model assumptions and specifications. Program benefits exceeded costs even under the most conservative assumptions.

Discount rate—Because economic returns vary substantially by the choice of discount rate, we estimated program benefits using annual discount rates of 0 to 7%. As shown in Figure 2, economic benefits of CPC preschool to society and to the general public exceeded costs even under the highest discount rates. Findings based on a 6% discount rate, which exceeds that used all previous CBAs, yielded a societal net present value of approximately $52,000 per participant (benefit/cost ratio of $6 per dollar invested) and to the general public of approximately $37,000 per participant (benefit/cost ratio of $4.50 per dollar invested). Respective benefit/cost values for the school-age ($2.50 and $1.50 per dollar invested) and the extended program ($5 and $4 per dollar invested) also remained positive. The discount rate at which benefits equal costs (internal rate of return) were 18% for preschool and extended intervention and 10% for school-age (exclusive of child care and child maltreatment benefits).

Earnings estimates—Alternative estimates of earnings and tax revenues yielded findings similar to those in Table 4. Using data from different cohort years and cohort groups of the Current Population Survey and African American workers with "any work experience" led to higher earnings estimates. Different estimates for program effects also were available. Our estimates from age 24 were slightly higher than at age 25 and slightly lower than at age 23 (see White et al., 2009). We also found that economic returns were only slightly affected by alternative assumptions about annual growth rates in earnings over the life course. For

each 0.5 percentage-point change in projected annual income growth, the return per dollar invested changed by only $0.20 to $0.30. Based on a 1.5% annual rate of income growth compared to the 2% used above, the preschool return was reduced from $10.83 to $10.54 per dollar invested. Further corrections for the administrative costs of tax collections ("deadweight" costs), which are typically estimated at 20 to 50% of revenue, would reduce returns by $0.20 to $0.50. This is generally consistent with the Perry preschool reanalysis (Heckman et al., in press).

Exclusion of intangible crime victim savings—Our crime savings estimates included averted tangible and intangible costs to crime victims. The exclusion of intangible savings (i.e., reduced pain and suffering, risk of death), which are more difficult to accurately assess than tangible benefits, resulted in decreases in societal returns per participant of $29,324, $1,784, and $12,880, respectively, for preschool, school-age, and extended intervention. The returns per dollar invested were $7.39, $3.50, and $5.74.

Inclusion of smoking benefits—Although group differences in daily smoking were not statistically significant at 10% level, we nevertheless calculated participant benefits for preschool because of the large negative health consequences (rates for school-age and extended participants were nearly identical). The societal return was modestly increased by $14,976 per preschool participant (to $107,196 from $92,220) or $1.76 per dollar invested (to $12.59 from $10.83). Notably, this increased return was conservative because the effects of educational attainment and substance misuse were taken into account.

Monte Carlo simulations—We incorporate uncertainty in program effectiveness for each outcome by conducting Monte Carlo analysis to assess the robustness of our results.. Based on a normal distribution of effect sizes and 10,000 iterations, the preschool program had a positive net benefit in 100% of the iterations (min.= $30,707, max = $142,753; mean = $83,673) with benefit/cost ratios ranging from $4.61 to $17.77 and a mean of $10.83. The extended intervention had a positive net present value (min. = $19,710, Max = $89,504; mean = $37,405) as well as benefit/cost ratio in 99.4% of the iterations whereas the school-age intervention did in 86% of iterations (min. = −$27,248, max = $51,990; mean = $11,272).

DISCUSSION

Findings indicate that CPC program participation was linked to relatively high economic returns to society and the public estimated from improved well-being by age 26. Total economic benefits per participant to society were estimated to be $92,220 for preschool, $15,064 for school-age, and $42,520 for preschool plus school-age (extended) intervention. Total public benefits per participant ranged from $8,000 to $61,246, which corresponds to a $2.11-$7.20 return per dollar invested. Males and high risk participants benefitted more from preschool and extended intervention while females benefitted more from school-age intervention. Findings were robust across alternative specifications and estimation procedures such as varying discount rates and benefits from taxation . Inclusion of smoking mortality benefits increased the economic returns whereas exclusion of intangible crime victim costs reduced economic returns. Monte Carlo simulations indicated that under a wide range of program estimates, the economic benefits exceed costs in nearly all iterations across the three program components. This study also goes well beyond the previous CBA by examining a wider range of outcomes in adulthood, using measures of adult crime and updating others, and comparing benefits by child and family subgroups.

Major Contributions

As the first adulthood CBA of a sustained large-scale early intervention, our findings indicate that routinely-implemented school-based programs can achieve high levels of cost-effectiveness. Almost all previous CBAs have either been of model programs, consist of forecasts of future benefits based on short-term results, or were based on research syntheses. The most investigated has been the High/Scope Perry Preschool, which as a demonstration program differs with large-scale programs in several respects. It was in one site that enrolled 58 children. Each class had four masters-level teachers with 6 to 1 ratio of children to staff and there were weekly home visits. This contributed to the relatively high cost per child of over $18,000. At half of the preschool cost of the Perry program, CPC has been established in the Chicago Public Schools for over 4 decades. Although costing moderately more than other contemporary federal and state-financed programs, the CPC program has generally similar teacher qualifications, class sizes and ratios, instructional approaches, school-based structures, and scope of services. Studies of both the Perry program and the CPC program contribute to evidence supporting high economic returns of preschool programs for children at risk (Karoly et al., 2005; Reynolds & Temple, 2008)

The CPC school-age component, which also demonstrated positive economic benefits, had reduced class sizes and teacher aides for each class, extra instructional supports, and a family support program. It also was integrated with the preschool and kindergarten programs. No other preschool to third grade programs have been investigated for economic benefits into adulthood. The economic returns of the extended intervention were higher than school-age intervention.

The second major contribution is that findings support the benefits of interventions beginning in preschool. Although the net economic benefits and returns were positive for each program component, the preschool component demonstrated the greatest benefits and highest returns. As found in previous studies (Reynolds, 2000; Reynolds et al., 2001, 2007), CPC preschool has demonstrated larger and more enduring effects across domains of child development than the school-age component. This is especially true for the economically-consequential outcomes of educational attainment and crime. Given differences in intensity and comprehensiveness of services, however, the finding of higher economic returns for preschool is not surprising. For example, preschool classes were limited to 17 children, which allowed more individualized instruction. Family services were more comprehensive, which contributed to greater parent involvement. Moreover, preschool intervention is designed to promote school transition at a sensitive period of development.

Although the economic benefits of the school-age and extended intervention components were lower than those of the preschool component, they were sizeable. With a return of 2 to 3 dollars per dollar invested, the cost-effectiveness of the school-age program exceeds most other programs assessed for economic benefits (Aos et al., 2007; Reynolds & Temple, 2008). The benefits of the extended intervention program exceeded costs by a factor of 5 to 7. Children who participated in the CPC extended intervention from preschool to second or third grade had the highest levels of well-being in adulthood.

Our findings are generally consistent with the larger CBA literature. In an analysis of 15 economic studies of programs from birth to age 9, Reynolds and Temple (2008) found an average economic return of $2.83 per dollar for interventions implemented before age 5 and $1.79 for those implemented at ages 5 to 9. However, the number of studies at different ages is small, limiting generalization. Moreover, the evidence does not support the conclusion that benefits are a function of age at program entry. For example, among birth to age 5 programs, those for 3- and 4-year-olds had higher average return than birth to 3 programs ($4.44 vs. $2.75).

The third major contribution is that economic benefits were found to vary by child, program, and family subgroups. Studies of other programs have not included this range of subgroups due to their small sample sizes. Consistent with the compensatory enrichment perspective of ecological and resilience theories, the CPC preschool program had higher economic returns for children at higher risk of school failure. Boys, children exposed to higher family risks, and children whose parents did not complete high school derived returns that were 2 to 4 times higher than other children. This pattern of compensatory benefits has been found for other interventions including home visiting programs (Karoly et al., 1998) and class size reduction (Finn et al., 2001; Krueger, 2003). That children at higher levels of risk of school failure benefitted most indicates the advantages of tailoring services to maximize program efficiency. Our finding that 1 year of preschool was associated with higher economic returns than 2 years suggests greater efficiency in increasing access to high quality preschool programs.

In contrast, the CPC school-age program was associated with higher economic returns for females. As the school-age intervention was not as intensive or comprehensive as preschool, it would be less likely to counteract the preexisting and continuing risks faced by different subgroups, including boys. For example, CLS boys had lower average scores on early academic achievement and social adjustment, and were less likely to enroll in higher-quality schools (Reynolds, 2000).

Although findings that males derive higher economic returns from preschool than females is consistent with the age 21 analysis (Reynolds et al., 2002), the Perry preschool (Schweinhart et al., 1993) and Abecedarian programs (Barnett & Masse, 2007) show that females benefit more. It is possible that the inner-city context of the CPC program encourages a greater intensity of focus on children most at risk. Or perhaps the teacher-directed instructional approach on literacy benefitted boys more, as previous studies show greater achievement gains for males (Reynolds, 2000). These differences within and between studies warrant further investigation.

Sources of CPC Intervention Effects

As a high-quality program, CPC has many features that contribute to its effectiveness. Unlike most other early childhood programs, CPCs provide comprehensive services to children and families over ages 3 to 9 in a school-based setting. This context facilitates continuity and integration of services from preschool to kindergarten and into the early grades. Second, as a public-school program, all teachers have 4-year degrees, are certified in early childhood, and are well-paid. Teachers have aides in each class and classrooms are limited to 17 children in preschool and 25 in the elementary grades. The parent program is the third key element. With a staffed parent resource room in each center, comprehensive family services and resources are provided and tailored to parent's needs. Compared to other programs, parent involvement in children's education is high. Indeed, this is one source of effects on school success (Reynolds, 2000). Finally, with an instructional philosophy emphasizing school success, the activity-based curricula is literacy intensive within a teacher-directed classroom structure.

To better understand the processes of long-term effects of CPC leading to cost-effectiveness, Reynolds (2000) developed a five-hypothesis model of well-being in which the long-term effects are explained by the cognitive advantage, social adjustment, family support, motivational advantage, and school support mechanisms. Studies of the five-hypothesis model demonstrate that CPC leads to cumulative advantages in adolescence and young adulthood primarily through the cognitive advantage, school support, and family support hypotheses (Ou, 2005; Reynolds et al., 2004; Reynolds & Ou, 2008). For example, Reynolds and Ou (2008) found that cognitive advantage (measured cognitive skills and achievement),

school support (school quality and mobility), and family support (parent involvement and child maltreatment) each accounted for one quarter of the total impacts of preschool on adult felony arrest. Motivation and social adjustment contributed significantly to model fit. The five-hypothesis model also accounts for effects on educational attainment in the Perry Preschool Program and Abecedarian Project (Reynolds, Englund, Campbell, Schweinhart, & Ou, in press). The model should be tested across a wider range of studies and programs.

Limitations

This study has 3 limitations that restrict inferences about economic benefits. First, the CPC program is high in quality. Certified teachers run small classes and integrate services between preschool and the school-age years. Curricula emphasize language and number skills, and field trips are relatively frequent. Comprehensive family services also are provided. Lower quality programs and those that are less intensive and comprehensive would not be expected to yield similar long-term effects and cost-effectiveness. For example, most state-funded preschool programs do not provide comprehensive family services and follow minimum standards on class sizes (Barnett et al., 2008). Nevertheless, because the CPC program is a sustained intervention implemented in a large urban school district, the findings are more generalizable than those of previous efficacy trials.

A second limitation is that some estimates were based on projected versus actual benefits. Lifetime income was primarily estimated from educational attainment by age 25. Although this is the standard approach, actual participant earnings may provide a more accurate accounting of economic status and increased tax revenues. Other measures of economic well-being are limited, given that some participants have not completed their education, receive public aid, or have involvement in the criminal justice system. Treatment savings associated with the prevention of depression symptoms, substance misuse, and tobacco use also are projected from self-reports and administrative records by early adulthood. To compensate for the possibility of unrealized treatment savings, our estimates of these benefits are conservative. For example, savings from reduced depressive symptoms were based on only two years of costs. This limitation is mitigated to some extent by the pattern of findings between age 21 and 26. Projections of adult criminal justice costs from juvenile costs were similar to actual costs determined from age 26 crime data.

The third study limitation is that there are likely to be unmeasured economic benefits. Benefits for higher levels of health insurance were not directly estimated under the assumptions that the lack of insurance may overlap with other benefits categories such as earnings, health and mental health treatment, and involvement in the justice system. For example, fringe benefits were estimated as part of lifetime earnings of which health insurance is a major element. Public aid receipt also was not estimated. Study participants have similar rates of participation and estimated benefits are likely to be small. Even under conservative assumptions, the addition of smoking mortality benefits would have added $1.76 per dollar invested to the CPC preschool return ($12.59 from $10.83 per dollar invested)

Benefits for parents or other family members were not estimated. Previous studies have found that program participation is associated with greater parent involvement (Reynolds et al., 2002), higher parental educational attainment for parents, and lower disability (Reynolds et al., 2007). These could be expected to translate into economic benefits. Carry-over benefits to siblings, workplace productivity, and to lower disease risks also are possible. Higher educational attainment, for example, is linked to greater use of preventive health services and lower risk of cardiovascular disease (Shea et al., 1991, U. S. Department o Health and Human Services, 2001). One advantage to not including all categories is to

compensate for the possibility of overestimating economic benefits in other categories. As more benefit categories are added the risk of double-counting increases.

Raising Healthy Children: Implications for Policy and Practice

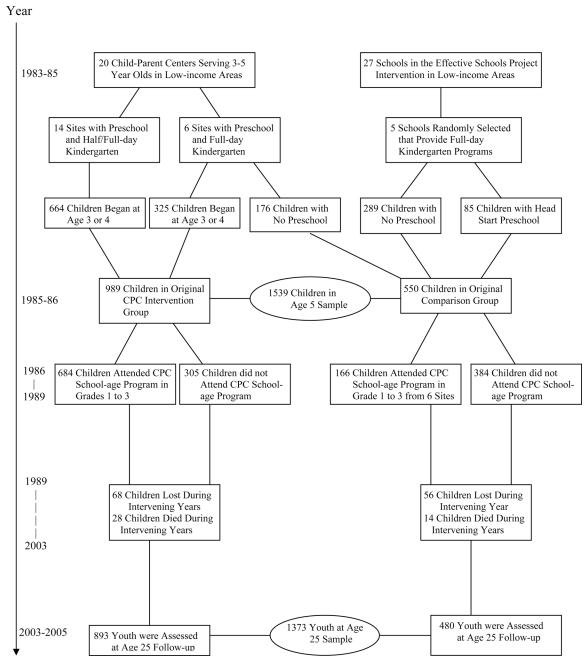
Study findings support the large economic benefits of the CPC program in promoting child health and well-being. The preschool component showed the strongest impacts and benefits, followed by the preschool plus school-age component, and the school-age component alone. Several implications are evident. First, greater investments in high-quality preschool programs are warranted. Although state funding of preschool programs has increased substantially over the past decade, only 22% of 4-year-olds nationally participated in state-funded programs (Barnett et al. 2008). Twelve states have no state-funded prekindergarten. Based on the accumulated research evidence in our study and in others (Aos et al., 2007; Karoly et al., 2005; Lynch, 2007), increasing preschool access is an efficient use of public resources. The returns of preschool education are higher than for most other programs (Greenwood, 2006; Lynch, 2007; Reynolds & Temple, 2008). To ensure that programs are high in quality, key principles of effectiveness found in CPC and other cost-effective programs are evident. These include services that (a) are of sufficient length or duration, (b) are high in intensity and enrichment, (c) small class sizes and ratios (d) are comprehensive in scope, and (e) implementation by well-trained and compensated staff. Although adhering to these principles increases program costs, the benefits that follow in improved well-being are expected to be large.

A second implication is that supporting children's transition to school through effective intervention deserves higher priority. The CPC model is a coordinated system of early education beginning at age 3 and continuing into kindergarten and the early school grades. Program implementation within a single administrative system in partnerships with communities can promote stability in children's learning environment which strengthen transitions early in the schooling process. Although further research is needed on different models of school transition (Bogard & Takanishi, 2005), findings from this study demonstrate that extended intervention strengthens learning gains from preschool and is independently associated with school performance leading to adult well-being. Other school-age programs that have evidence of positive economic returns include reduced class size (Krueger, 2003) and social and emotional learning programs (Reynolds & Temple, 2008). School transition programs are under-used approaches to improving child health and well-being.

In conclusion, the amount of evidence on the positive and enduring effects of high-quality early childhood programs is growing. There is not only a critical mass of evidence from long-term cost-benefit analyses of preschool programs such as CPC, but increasingly strong evidence from state-financed prekindergarten that participation is associated with sizeable increases in school readiness. Moreover, advances in knowledge on the mechanisms of long-term effects have strengthened confidence in the economic returns of programs. The accumulated literature shows that under modest assumptions, the impacts of upscaled and sustained programs can be positive and highly cost-effective.

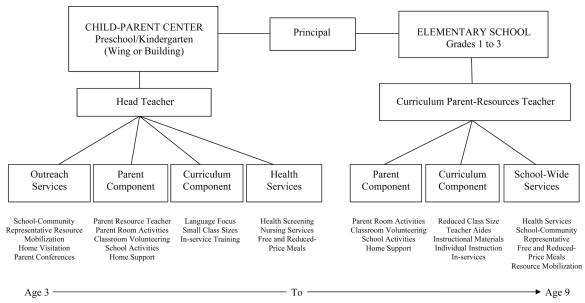
APPENDIX A

Flowchart of Study Sites and Participants in the Chicago Longitudinal Study (Preschool to Age 25)



APPENDIX B

Chicago Child-Parent Centers Program Model



APPENDIX C

Breakdown of Benefits and Costs for Estimating Economic Returns of the Chicago Child-Parent Centers (2007 dollars, 3% discount rate)

Category of Benefits and Costs	Estimate in $2007	Average Age of Benefit	Present Value in $2007	Preschool Benefit	Standard Error Preschool	School-age Benefit	Standard Error School-age	Extended Benefit	Standard Error Extended
Grade retention (ages 5–14)	9,173	19	5,716	880	226	600	177	594	165
Special education (ages 6–18)	9,910	12	7,596	5,317	1,573	3,646	1,252	5,089	1,274
Earnings (ages 18–65)	1,013,865	-	277,102	22,445	7,537	6,373	7,041	10,807	7,399
Tax contributions (ages 18–65)	273,704	-	78,996	6,399	2,149	1,817	2,007	3,081	2,109
Juvenile crime (ages 10–18)									

Category of Benefits and Costs	Estimate in $2007	Average Age of Benefit	Present Value in $2007	Preschool Benefit	Standard Error Preschool	School-age Benefit	Standard Error School-age	Extended Benefit	Standard Error Extended
CJS expenditures	24,105	14	17,414	5,747	2,123	-	-	2,438	1,881
Tangible victim costs	25,274	14	18,258	4,309	1,716	347	1,153	3,013	2,561
Intangible victim costs	83,198	14	60,104	14,185	5,648	1,142	3,795	9,917	8,431
Adult crime (ages 19–44)									
CJS expenditures	62,803	-	28,077	3,313	1,674	-	-	-	-
Tangible victim costs	65,849	-	29,439	3,474	1,755	-	-	-	-
Intangible victim costs	216,763	-	96,909	11,435	5,777	-	-	-	-
Child abuse and neglect (ages 4–17)									
CWS expenditures	50,669	10	41,199	3,090	1,074	536	858	2,472	822
Tangible victim costs	8,797	10	7,153	536	186	93	149	429	143
Intangible victim costs (ages 4–44)	86,482	-	49,384	3,704	1,287	642	1,029	2,963	986
Child care (ages 3–4)	4,472	3 to 4	-	4,387	-	-	-	1,512	-
College expenditures, 2 years									
Public expenditures (2/3)	(8,031)	18	(5,155)	(196)	89	(88)	89	(149)	100
Private expenditures (1/3)	(4,016)	18	(2,578)	(98)	45	(44)	44	(75)	50
Adult depression									
Treatment and employment costs	18,821	22	10,733	494	266	-	-	429	262
Substance misuse (ages 16–44)									
Treatment, medical, productivity and opportunity costs	134,055	-	62,212	2,800	1,424	-	-	-	-
Total Benefits	-	-	-	92,220	34,549	15,064	17,594	42,520	26,182
Public Benefits	-	-	-	61,246	25,493	8,000	9,331	26,884	17,605
Program Costs									
Preschool (ages 3–4)									
One year per child	5,597	4	5,434	-	-	-	-	-	-
Average per child (1.55 years)	8,675	3 to 4	8,512	-	-	-	-	-	-
School-age (ages 6–9)									
One year per child	2,010	6	1,839	-	-	-	-	-	-
Average per child (2.14 years)	4,301	6 to 9	3,792	-	-	-	-	-	-
Extended intervention (ages 3–9)									
Average per child (3.86 years)	13,363	3 to 9	12,719	-	-	-	-	-	-
Less extended program	-	-	7,556	-	-	-	-	-	-
Marginal cost of the extended	-	-	5,163	-	-	-	-	-	-
Net Present Value	-	-	-	83,708	26,037	11,273	13,803	37,357	21,019
Net Present Value (Public)	-	-	-	52,734	16,981	4,208	5,540	21,721	12,442

Category of Benefits and Costs	Estimate in $2007	Average Age of Benefit	Present Value in $2007	Preschool Benefit	Standard Error Preschool	School-age Benefit	Standard Error School-age	Extended Benefit	Standard Error Extended
Benefit-Cost Ratio	-	-	-	10.83	4.06	3.97	4.64	8.24	5.07
Benefit-Cost Ratio (Public)	-	-	-	7.20	2.99	2.11	2.46	5.21	3.41
Internal Rate of Return, %				17.8	-	9.8	-	18.0	-
Internal Rate of Return (Females), %				2.5	-	10.2	-	25.3	-
Internal Rate of Return (Males), %				21.6	-	0.0	-	25.3	-
Internal Rate of Return (One Year/Shorter Duration), %				21.1	-	10.7	-	19.5	-
Internal Rate of Return (Two Years/Longer Duration), %				15.5	-	8.6	-	20.2	-
Internal Rate of Return (Public), %				17.4	-	8.1	-	17.7	-

Note: The benefits of program participation were estimated by multiplying the program coefficient in the explanatory model (see Table 3) by the present value of the outcome in column 4. Grade retention is the average expenditure for one additional year of general education in Chicago reported by Illinois State Board of Education. Special education is the weighted average of four handicapping conditions reported by the Chicago Public Schools: specific learning disability, speech or language impairment, emotional or behavioral disturbance, and mental retardation. Projected lifetime earnings and compensation estimates assume a 3% annual discount rate, 2% real income growth rate, and 43.5% fringe benefit rate. The tax rate is applied to projected lifetime earnings only and is assumed to be 33.3% (15% federal, 3% state, and 15.3 FICA). In estimating the earnings/compensation benefit, the program effect on high school completion by age 24 (8.1 percentage points for the preschool intervention, 2.3 percentage points for school-age intervention, and 3.9 percentage points for the extended intervention) was multiplied by the projected present value life-time earnings benefit from completing high school ($277,102). Crime victim costs are tangible expenditures to victims for adjudicated violent and property offenses (Karoly et al., 1998; Barnett, 1996; Miller et al., 1996). Criminal justice system costs include administrative, treatment, and probation expenditures (Cohen, 1988; Bureau of Justice Statistics, 1997; Illinois Department of Corrections, 1999). The internal rate of return excludes childcare benefits and savings associated with reduced child abuse and neglect. Estimates may not be exact due to rounding. For additional information on program costs and activities, see Reynolds (2000). Contact the authors for additional information on the estimation of benefits and costs.

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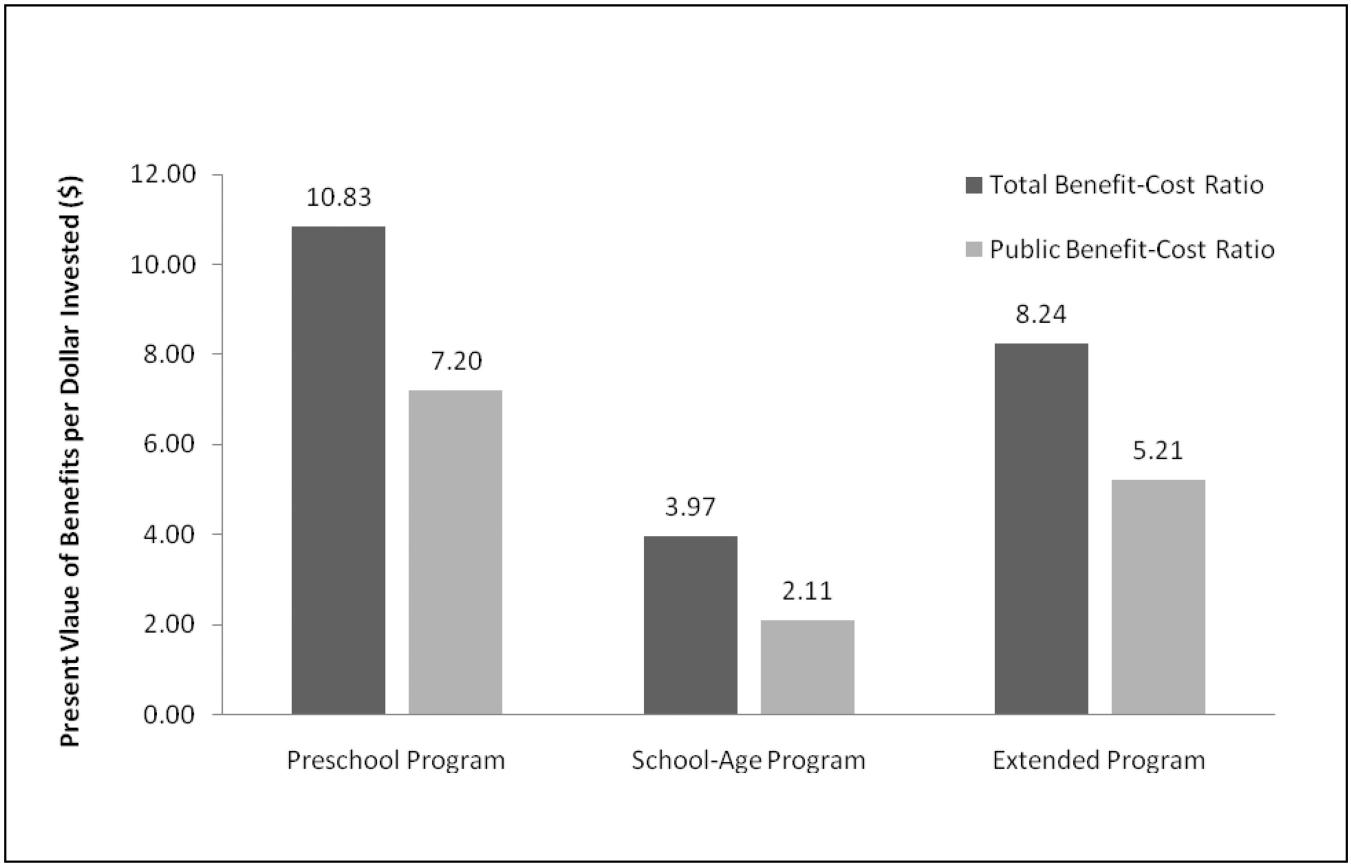

FIGURE 1.

Benefit-Cost Ratios for Three Levels of CPC Participation (2007 dollars, 3% real annual discount rtae)

Note: The 90% confidence intervals for the total benefit-cost ratios for the preschool, school-age, and extended programs are 4.15 to 17.51, -3.66 to 11.60, and 0.10 to 16.58, respectively. The 90% confidence intervals for the public benefit-cost ratios for the preschool, school-age, and extended programs are 2.28 to 12.11, −1.94 to 6.16, and −0.40 to 10.82, respectively. The 90% confidence intervals were generated by monetizing the standard errors associated with the estimated program effects. A Monte Carlo Analysis was also conducted to estimate the range of benefit-cost ratios, and the analysis generated a comparable range of estimates

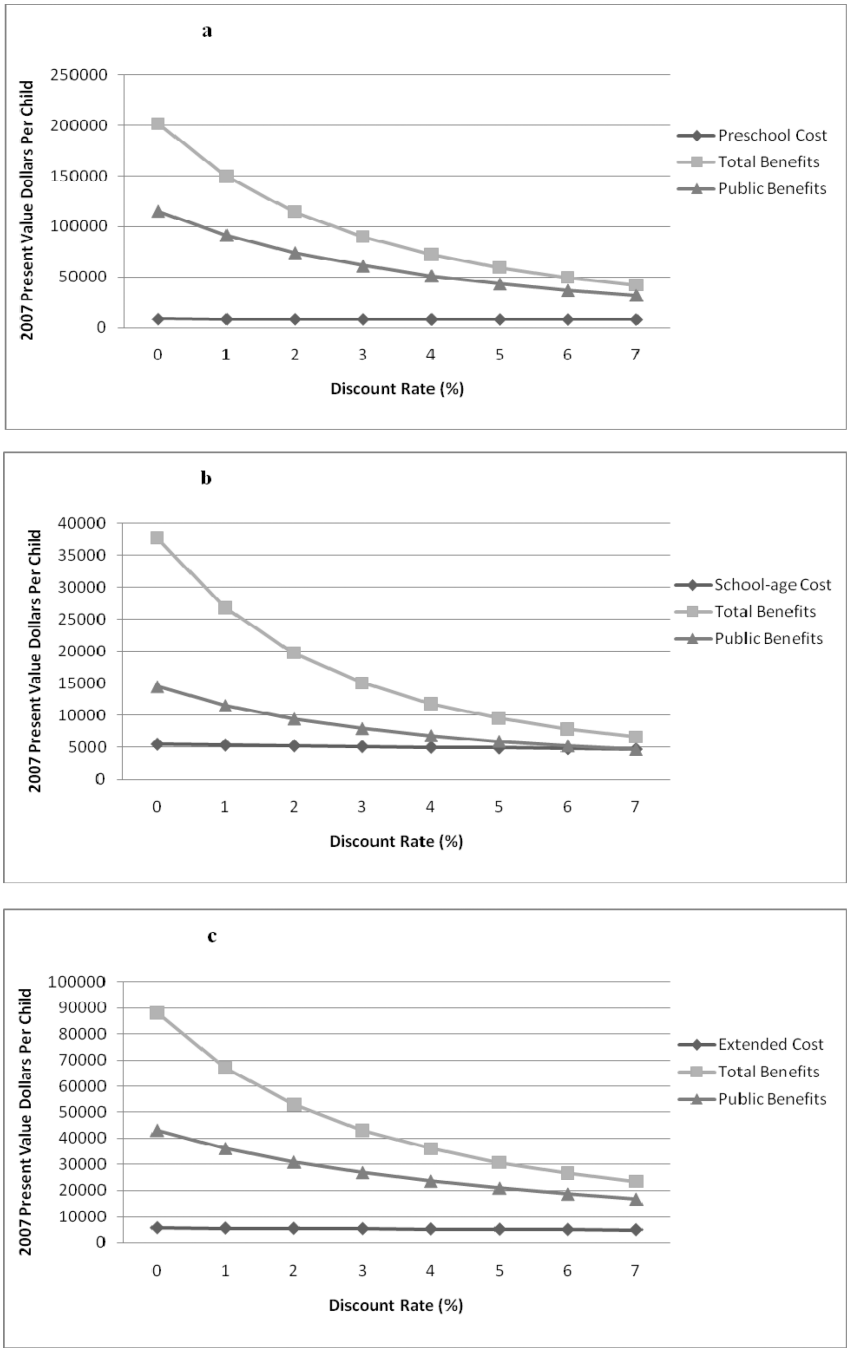

FIGURE 2.

a: Sensitivity Analysis for Estimated Total and Public Benefit and Costs for the CPC Preschool Program

b: Sensitivity Analysis for Estimated Total and Public Benefit and Costs for the CPC School-Age Program

c: Sensitivity Analysis for Estimated Total and Public Benefit and Costs for the CPC Extended Program

TABLE 1

Patterns of Participation of Original Intervention and Comparison Groups in the CLS

Study category	Total Sample	Preschool Intervention Group*	Comparison Group*
Program Participants' Characteristics at Start of Study**			
Original Sample	1539	989	550
No. of cases with preschool participation	1073	989	84
No. of cases with CPC preschool	989	989	0
Years in CPC preschool (0–2)	-	1.55	0.0
No. of cases with Head Start preschool	85	1	84
No. of cases with kindergarten participation	1539	989	550
No. of cases with CPC participation	989	989	0
Full-day kindergarten, %	-	59.9	100.0
No. of cases with CPC school-age participation	850	684	166
Years of school-age program (0–3)	-	1.43	0.68
School-age participation, %	-	69.2	30.2
No. of cases with CPC extended intervention (4–6y)	553	553	0
Extended participation, %	-	55.9	0.0
Total years of CPC program (0–6)	-	3.95	0.68
No. of cases with no CPC participation	384	0	384
No. of Lost cases in Post-program Years			
Moved***			
From ages 6–10y	69	41	28
After age 10y	52	30	22
Other	11	4	7
Child death	18	12	6
Follow-up Study Characteristics of Participants at Age 24–26, No. of cases with data			
Educational attainment	1373	893	480
Arrest and incarceration	1473	523	950
Educational attainment and arrest and incarceration	1364	887	477
Substance misuse	1473	950	523
Depression	1134	744	390
One or more adult outcomes	1445	936	509

*Cases for program participation cover the 6-year period (1983–1989) that defines enrollment in the CPC intervention.

**The CPC preschool comparison group participated in a full-day kindergarten program, and 84 had Head Start preschool. 176 cases in the preschool comparison group were eligible to receive limited services in the CPC kindergarten but enrolled in different classrooms. They are not part of the original CPC intervention group. Some cases in the comparison group participated in the school-age program because it was open to any child enrolled in elementary school from first to third grade. Fifteen children in the CPC intervention group enrolled in the alternative full-day kindergarten.

***These categories account for attrition from the original study sample of 1,539. Cases were lost during post-program years because they moved from Chicago and could not be located, were deceased, or either did not have sufficient identifying information to track, refused to participate or were incarcerated (other). At age 24, the total number of deceased cases in the study was 41.

TABLE 2

Equivalence of CPC Preschool Intervention and Comparison Groups on Pre-Program Attributes for the Adult Follow-up Study

	Adult Follow-up Sample (n = 1373)*			
Child/Family Characteristics**	**Preschool Intervention Group (N=893)**	**Comparison Group (N=480)**	***p*-value**	**Original Sample *p*-value**
Sample recovery, %	90.3	87.3	-	-
African American child, %	93.4	93.1	.85	.59
Female child, %	54.1	48.3	.04	.11
Low birth weight (<2500g), %	11.5	14.7	.10	.11
≥ 60% low income families in school attendance area, %[x]	77.6	72.9	.05	.04
≥ 40% of persons living in poverty in area of residence, %	69.9	54.0	.000	.000
Child welfare case history by age 4, %	2.9	5.0	.05	.08
Parent under age 18 at child birth, % [x]	16.4	18.2	.40	.29
Mother did not complete high school, % [x]	50.5	58.7	.004	.001
Single parent family status, % [x]	76.3	74.9	.58	.59
Mother not employed, % [x]	64.5	59.6	.09	.11
Child eligible for subsidized meals, % [x,y]	83.1	82.4	.76	.39
Participate in TANF program, % [x]	62.4	60.4	.48	.59
Four or more children in family, % [x]	16.4	19.7	.14	.27
Frequent family conflict, %	6.2	5.2	.48	.48
Family financial problems, %	7.5	6.2	.41	.40
Undesirable early home environment, % [z]	13.9	11.3	.91	.72
Missing 1 or more risk factors, %	12.4	15.2	.15	.03
Risk index (0 to 8), mean (SD)	4.32 (1.74)	4.28 (1.79)	.73	.39

*The adult follow-up sample had known educational attainment by August 2005. P values show the significance of mean (or percentage) group differences for age 25–26 and the original samples. The preschool comparison group participated in an alternative full-day kindergarten but had no CPC preschool participation. School-age and extended intervention groups had similar profiles as the CPC preschool group.

**Data on child and family characteristics were collected from birth to age 3 based on multiple administrative records and parent surveys. Data on TANF (Temporary Assistance for Needy Families) and subsidized meals were collected up to age 8. Sample sizes ranged from 1234 to 1373 (follow up sample). They ranged from 1342 to 1539 for the original sample.

[x]Variable included in the risk index.

[y]Eligibility defined at <130% of the federal poverty level.

[z]Defined as frequent family conflict, financial problems, or parental substance abuse from age 0 to 5 years.

TABLE 3

Estimated Effects for Three Measures of Participation in the Child-Parent Centers

	Preschool Program			School-Age Program			Extended Program		
Domain and Measure	**Preschool Group (n=950)**	**Comparison Group (n=523)**	**Diff.**	**School-Age Group (n=826)**	**Comparison Group (n=647)**	**Diff.**	**Extended Group (n=543)**	**Comparison Group (n=567)**	**Diff.**
School remedial services									
Grade retention by age 15, %	23.0	38.4	−15.4***	23.8	34.3	−10.5***	21.9	32.3	−10.4***
Special education by age 18, %	14.4	24.6	−10.2***	15.4	21.3	−5.9*	13.5	20.7	−7.2**
Number of years of special ed. from ages 6 to 18	0.73	1.43	−0.70+	0.76	1.24	−0.48+	0.56	1.23	−0.67+
Child maltreatment									
Any indicated abuse or neglect from ages 4 to 17, %	9.9	17.4	−7.5***	12.0	13.3	−1.3	8.4	14.4	−6.0**
Any out of home placement, %	5.2	8.5	−3.3*	6.0	6.4	−0.4	3.9	6.0	−2.1
Juvenile arrest by age 18									
Petition to juvenile court, %	16.9	25.1	−8.2**	19.8	19.8	0.0	19.2	20.1	−0.9
No. of petitions to juvenile court	0.45	0.78	−0.33*	0.56	0.58	−0.02	0.48	0.62	−0.14
Educational attainment by age 25									
High school completion, %	79.7	72.9	6.8**	79.1	75.4	3.7	82.0	77.4	4.6+
Highest grade completed	12.08	11.80	0.28**	12.00	11.90	0.10	12.13	11.9	0.23*
Completed .5 credits at a 4-year college, %	10.9	7.1	3.8*	10.1	8.4	1.7	12.9	10.0	2.9
Adult crime by age 26									
Any felony arrest, %	13.3	17.8	−4.5*	19.1	17.8	1.3	13.6	14.0	−0.4
No. of felony arrests	0.32	0.44	−0.12*	0.36	0.34	0.02	0.35	0.34	0.01
Health and mental health									
Reported any depression symptom, %	12.8	17.4	−4.6+	14.5	14.0	0.5	12.1	16.1	−4.0+
Substance misuse, %	14.3	18.8	−4.5*	16.3	15.1	1.2	15.2	16.8	−1.6
Daily tobacco use, %	17.9	22.1	−4.2	19.1	19.5	−0.4	17.9	18.2	−0.3
Health insurance by age 26									
Any health insurance, %	76.7	66.6	10.1***	72.0	75.1	−3.1	77.2	71.8	5.4+

Domain and Measure	Preschool Program: Preschool Group (n=950)	Preschool Program: Comparison Group (n=523)	Preschool Program: Diff.	School-Age Program: School-Age Group (n=826)	School-Age Program: Comparison Group (n=647)	School-Age Program: Diff.	Extended Program: Extended Group (n=543)	Extended Program: Comparison Group (n=567)	Extended Program: Diff.
Economic status									
Number of months of Food Stamps, ages 18 to 24	17.50	18.78	−1.28*	17.96	17.96	−0.00	17.55	18.22	−0.67
Occupational prestige by age 24	2.79	2.55	0.24**	2.70	2.70	0.00	2.84	2.66	0.18+

*** $p \leq .001$

** $p \leq .01$

* $p \leq .05$

+ $p \leq .10$.

The sample size of the preschool and the school-age intervention measures ranges from 1281 for school remedial services to 1473 for adult crime by age 26. The sample size of the extended intervention measures ranges from 971 to 1110. Coefficients are from linear, pobit, or negative binomial regression analysis. Coefficients for school remedial services and juvenile delinquency measures are adjusted for sex of child, race/ethnicity, the risk index, program sites, earlier/later program participation, and word analysis scores at the end of kindergarten. All other coefficients are adjusted for the 8 indicators of preprogram risk status, gender, race/ethnicity, child welfare history, a dummy-coded variable for missing data on risk status, and word analysis scores at the end of kindergarten. Word analysis scores were only included for the extended intervention models. The non-extended intervention group had 1 to 3 years of CPC intervention, and the extended intervention group had 4–6 years of intervention. Sample comparisons are based on published studies whenever possible. Occupational prestige in the CLS sample ranges from 1 to 8, with 4 indicating moderate prestige. The measure of occupational prestige is based on ratings from the 1989 General Survey (Davis, Smith, Hodge, Nakao, & Treas, 1991) and a scale developed by Barratt (2005).

TABLE 4

Costs and Benefits of the Chicago Child-Parent Center Preschool, School-Age, and Extended Programs per Participant (2007 dollars, 3% real annual discount rate)

Benefit or Cost	Participants	General Public	Society (Participants and General Public)
Preschool Program			
Measured effect			
Child care	4,387		4,387
Child abuse and neglect	4,240	3,090	7,330
Education			
Grade retention	-	880	880
Special education	-	5,317	5,317
College tuition	(98)	(196)	(294)
Earnings/compensation	22,445	6,399	28,844
Criminal behavior			
Ages 10–18	-	24,240	24,240
Ages 19–44 Health	-	18,222	18,222
Health			
Depression	-	494	494
Substance misuse	-	2,800	2,800
Total benefits	30,974	61,246	92,220
Program costs	-	8,512	8,512
Net present value	30,974	52,733	83,708
School-Age Program			
Measured effect			
Child care	-	-	-
Child abuse and neglect	735	536	1,271
Education			-
Grade retention	-	600	600
Special education	-	3,646	3,646
College tuition	(44)	(88)	(131)
Earnings/compensation	6,373	1,817	8,190
Criminal behavior			-
Ages 10–18	-	1,489	1,489
Ages 19–44	-	-	-
Health	-	-	-
Depression	-	-	-
Substance misuse	-	-	-
Total benefits	7,065	8,000	15,064
Program costs	-	3,792	3,792
Net present value	7,065	4,208	11,273
Extended Program			

Benefit or Cost	Participants	General Public	Society (Participants and General Public)
Measured effect			
Child care	1,512	-	1,512
Child abuse and neglect	3,392	2,472	5,864-
Education			-
Grade retention	-	594	594
Special education	-	5,089	5,089
College tuition	(75)	(149)	(224)
Earnings/compensation	10,807	3,081	13,888
Criminal behavior			-
Ages 10–18	-	15,368	15,368
Ages 19–44	-	-	-
Health			
Depression	-	429	429
Substance misuse	-	-	-
Total benefits	15,636	26,884	42,520
Program costs	-	5,163	5,163
Net present value	15,636	21,721	37,357

TABLE 5

Net Present Value (NPV) and Total Estimated Return per Dollar Invested (B/C) for Selected Subgroups (2007 dollars, 3% real annual discount rate)

	Preschool Program NPV (B/C)	School-Age Program NPV (B/C)	Extended Program NPV (B/C)
Duration of Services			
Overall average	83,708 (10.83)	11,273 (3.97)	37,357 (8.24)
One year/shorter duration	68,347 (13.58)	17,103 (10.30)	39,967 (9.32)
Two years/longer duration	83,179 (8.54)	8,087 (2.90)	41,453 (7.93)
Selected Subgroups			
Male	143,716 (17.88)	−924 (0.76)	56,630 (11.97)
Female	14,187 (2.67)	28,144 (8.42)	13,757 (3.66)
High risk	100,550 (12.81)	18,394 (5.85)	54,143 (11.49)
Low risk	52,876 (7.21)	−2,677 (0.29)	13,674 (3.65)
Mother did not complete high school	126,683 (15.88)	8,323 (3.20)	41,680 (9.07)
Mother completed high school	36,867 (5.33)	14,362 (4.79)	29,863 (6.78)
Reside in high poverty area	144,065 (17.92)	25,948 (7.84)	42,200 (9.17)
Reside in relatively low poverty area	25,978 (4.05)	835 (1.22)	32,988 (7.39)

Note: In 2007 dollars, the discounted present value costs for one and two years of CPC preschool are $5,434 and $11,031, respectively. The cost for two to three years of school-age services, above the cost for regular educational services, is $4,266. Per pupil costs for four years of CPC intervention and five to six years of CPC intervention, above the cost for one to three years of CPC intervention are $4,805 and $5,979, respectively. Longer duration for school-age was 2–3 years. Shorter and longer duration for extended group was 4 and 5–6 years, respectively. Risk was defined as 4 or more early risk indicators (see Table 1 for a list of early risk indicators). High poverty is defined as residence in area in which 40% or more families live in poverty. Undesirable early home environment factors include frequent family conflict, financial problems, or parental substance abuse from age 0 to 5 years.