Effects of a Preschool and School-Age Intervention on Adult Health and Well Being: Evidence from the Chicago Longitudinal Study

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ABSTRACT

Context. Although the benefits of early childhood interventions are well established, few studies have investigated effects into adulthood, especially for large-scale, publicly funded programs. Previous studies of one of the oldest federally funded early childhood programs found that participation is linked to greater well-being by the end of adolescence but enduring impacts on broader indicators of adult health and well-being are undocumented. Effects on parents of participants also have not been fully investigated.

Objective. To determine the effects of an established preschool and school-age preventive intervention on the general health and well-being of urban, low-income children and their parents in young adulthood.

Design, Participants, and Setting. Twenty-year follow-up at age 24 of an alternative-intervention matched-group cohort of 1539 low-income children (93% black, 7% Hispanic) born in 1979 or 1980 and who enrolled in the Child-Parent Center (CPC) Program in 20 sites or an alternative early childhood intervention in randomly selected or matched schools in Chicago, Illinois.

Interventions. Attended by a complete cohort of 989 children, the CPC program provides educational enrichment, family support services, and health services in the Chicago public school system. It includes half-day preschool at ages 3 to 4 years, half- or full-day kindergarten, and school-age services in affiliated schools up to third grade (ages 6 to 9). The comparison group of 550 children participated in full-day kindergarten programs from (a) 5 randomly selected schools in low-income neighborhoods (n = 374) and (b) from 6 CPCs without preschool participation (n = 176). These kindergarten programs were the usual “treatment” for low-income children.

Main Outcome Measures. High school completion, years of completed education, and college attendance; adult criminal behavior; health insurance coverage, substance and tobacco use, depressive symptoms; economic well-being including public aid receipt and employment; child abuse and neglect, and out of home placement. For parents, the main outcomes were educational attainment, economic well-being, and disability status.

Results. Relative to the comparison group and adjusted for many background factors, CPC preschool participants at age 24 had higher rates of school completion (71.4% vs 63.7%), higher rates of attendance in 4-year colleges (14.7% vs 10%), and more years of completed education (11.7 vs 11.4 yrs, p = .001). They were more likely to have health insurance (70.2% vs 61.5%, p = .005). They also had lower rates of incarceration (20.6% vs. 25.6%; p = .03) and convictions; lower rates of depressive symptoms (12.8% vs 17.4%, p = .057), and lower rates of out-of-home placement (4.7% vs 8.8%, p =.005). Participation in the school-age program was linked to fewer months on public aid, a lower rate of disability, and lower rates of teenage parenthood. Participation in both preschool and school-age programs was primarily associated with higher rates of high school completion (73.9% vs 65.5%, p = .002) and 4-year college attendance, and more years of completed education (11.8 vs 11.5 yrs, p = .001); higher rates of full-time
employment (42.7% vs 36.4% p = .039); lower rates of arrests for violent offenses (13.9% vs 17.9%, p = .038) and multiple incarcerations (7.5% vs 9.7%, p = .019), and lower rates disability. Some program effects were stronger for males, 2-year preschool participants, and children in centers rated high in child-initiative activities. For parents of study participants, both preschool and extended intervention were associated with higher educational attainment. Preschool intervention also was associated with lower rates of parental disability whereas extended intervention was associated with higher rates of parental employment.

**Conclusions.** Participation in a school-based intervention beginning in preschool was associated with a wide range of positive outcomes in adulthood for children and their parents. Findings provide strong evidence that established early education programs high in quality can be good investments.
Early childhood interventions have demonstrated consistent positive long-term effects on children’s health and well being. Their impacts are unique in two important ways. First, early childhood interventions (ECI) in the first five years of life show links to a broad range of positive outcomes up to two decades later, including better reproductive health and birth outcomes, higher cognitive skills, school achievement and performance, higher school completion and attainment, higher earnings capacity and lower rates of delinquency and crime, and school remediation.1-10 Positive outcomes for parents also have been documented in programs from birth to age 3.1,4 Most of these outcomes are key contributors to health status. Few if any other interventions have shown such multifarious impacts. The second unique feature of the empirical evidence is that ECIs have proven cost-effective in returning economic benefits through cost savings on treatment and increased earnings capacity to participants and the public that exceed costs by an average ratio of 6 to 1.11-13 This cost effectiveness is greater than other childhood investments.11,14 Consequently, public investments in early education are growing across the nation.

Although the intervention services to enhance children’s well-being range from prenatal nutrition and home visitation up to age 2 to early education by age 4, the focus on early intervention to promote health and well-being is only beginning to be documented as a health promotion strategy. Comprehensive preschool programs for low-income children provide center-based educational enrichment, family social services and parenting education, and health and nutrition services. Several limitations are evident. One is that there is only a small amount of evidence that large scale public programs demonstrate long-term effects into adulthood.1,15-16 Most previous studies have assessed small-scale model programs. A second major limitation is that no previous studies have investigated a broad set of health and well-being outcomes. Most of the evidence concerns school attainment and social behavior. Because education and delinquency are significant predictors of health behavior and economic well-being in adulthood,1,3 early childhood programs may have broader effects. Third, due to the traditional focus on model programs that include few families,6,7 differential effects by program, child, and family attributes have not been tested.17 It would be unexpected that programs have uniform effects. Finally, family outcomes of large scale early childhood interventions are not known. Because many early interventions provide family services such as parenting classes and health services, impacts on parents would be expected. In the Nurse-Family Partnership Program, home visitation by nurses in the first two years was associated with lower rates of teenage births and parent employment, and with lower rates of crime.18 Preschool programs and other early interventions have lacked similar family assessments.

One of the few studies of a large-scale program that has assessed effects comprehensively is the Chicago Longitudinal Study, which investigates the Child-Parent Center (CPC) Program. In an earlier study,9 participation in the CPC preschool intervention was associated with significantly higher rates of school completion by age 20 and with significantly lower rates of juvenile arrest for both violent and nonviolent offenses, and with lower rates of school remedial services. School-age intervention was associated with lower rates of school remedial services, and in addition extended intervention for 4-6 years was linked to significantly lower rates of remedial education and juvenile arrests for violent offenses. A cost-benefit analysis of the program revealed relatively high economic returns.20

In this report, we conduct a follow-up study at age 24 to determine program links with measures of educational attainment, economic status, crime, health status and behavior, mental health, and life course outcomes for parents of participants. The study is unique in several
respects. It is the first prospective investigation of a public early childhood intervention on adult well-being into the third decade. Second, it is one of the first studies to examine direct measures of health status and behavior including health insurance coverage, teen parenthood, and child maltreatment. We also investigated whether the effects of intervention vary program, child, and family factors. Previous reports have indicated that program length and instruction as well as high risk status are associated with greater childhood effects. Given our previous findings and the well-established links among educational attainment, SES, crime, and health status, we hypothesize that program participation, especially in preschool and continued into school-age, will be associated with greater adult well-being in several domains for both participants and their parents.

METHODS

Sample and Design
The Chicago Longitudinal Study is a prospective investigation of the life course of a cohort of 1539 low-income minority children (93% black, 7% Hispanic) born in 1979 or 1980 who attended early childhood programs in 25 sites in 1985-1986. Since 1985, data have been collected continuously on health and well-being from school records, frequent participant and family surveys, and many types of administrative records. The original sample included the complete cohort of 989 children who completed preschool and kindergarten in all 20 CPCs with combined programs. School-age services are provided in first to third grade in affiliated elementary schools. The preschool comparison group of 550 children in this quasi-experimental cohort design participated in alternative full-day kindergarten programs that were available to low-income families and 15% had Head Start preschool. The preschool comparison group included all 374 kindergartners from 5 randomly selected schools plus 2 others that had full-day kindergarten and extra instructional resources. The rest of the comparison group (n = 176) attended full-day kindergartens in 6 CPCs but had no preschool experience. They were located in separate classrooms but received some program services. As in previous studies, these two demographically similar groups were combined for analyses.

The intervention and comparison groups were matched on age, eligibility for and enrollment in government-funded early intervention, and neighborhood and family poverty. Neighborhood poverty is defined as residence in a Title I school area. Family poverty is defined as eligibility for the subsidized lunch program (185% of federal poverty line or lower). The intervention and comparison groups participated in the study under informed consent. The legal and ethical requirements to serve children most in need prevented random assignment in this established program. Approvals have been granted by institutional review boards at the Universities of Wisconsin-Madison and Minnesota.

Based on the study design, we assessed the impact of 4 measures of CPC participation. For preschool, children entering the program at ages 3 or 4 years (original cohort, n = 989) were compared to all others who did not participate in CPC preschool but had the alternative intervention (preschool comparison group, n = 550, see Table 1). The effects of CPC school-age intervention were estimated by comparing children enrolling for at least 1 year from first to third grade regardless of whether they enrolled in CPC preschool (n = 850) with those having no school-age program participation. (school-age comparison group, n = 689). The effects of CPC extended intervention were estimated by comparing children who began the CPC in preschool and continued through second or third grade for 4 to 6 years (n = 553) with 2 other groups: all other children who had less extensive or no participation (Extended-1, n = 986) and children whose CPC participation ended after kindergarten (Extended 2). Table 1 shows the pattern of participation and postprogram data collection in the study.

Four study features make group comparisons interpretable as program effects and they also strengthen causal inference. First, the comparison group was largely chosen from randomly selected schools participating full-day kindergarten, which was the “treatment as usual.” In addition, 15% of the
comparison group had Head Start. This contrast results in a conservative bias of program estimates compared to the more typical one in long-term studies between center-based intervention and home care. Second, over 80% of children in the neighborhood of the centers participated, which indicates that program participants are largely representative of the neighborhoods surrounding the centers. Most of the comparison group did not enroll in the CPCs because they did not live in a neighborhood with an intervention. Third, the pattern of effects for outcomes investigated in over time are largely explained by mechanisms central to the intervention theory, including the enhancement of developed abilities important for school success, family support behavior, and enriched school environments. Finally, results of a wide range of selection and attrition analyses have consistently indicated that program estimates are robust to alternative analytic techniques and model specifications, including latent-variable structural modeling and propensity score approaches.

Age 24 Follow-up and Comparability of Intervention Groups
At an average age of 24 years, 90.3% (n = 1,389) of the original sample had valid data on educational attainment or employment. Recovery rates for the preschool intervention and comparison groups were 91.2% and 88.6%, respectively. Rates were higher for crime and public aid data (92-94%) and lower for mental health and health outcomes based on the adult survey (77%). The high rates of sample recovery are due to the use of many sources of administrative and survey data and to follow up tracking. About two thirds of the sample resided in Illinois between ages 20-24, with many others remaining in the midwest. As in previous studies, there was no evidence of selective attrition by program status that would affect findings. Respondents to the adult survey were less likely to have criminal justice system histories than the original study sample but this did not vary by program status. Recovery rates for parent outcomes also exceeded 90%, with mothers of study participants usually being the primary data source.

As shown in Table 2, the age 24 follow-up groups and the original sample were similar on most characteristics. These were measured from state and local administrative records, and family surveys between birth and age 3, and are updated from the previous reports. The intervention and comparison groups were similar on parental employment (mothers), low-income status (measured by eligibility for subsidized lunches) and TANF, single-parent family and teen parenthood status, and large family size (4 or more children), and low birth weight status. They differed on parent educational attainment and neighborhood poverty status but in opposite directions, as the intervention group had higher rates of both parental high school completion and neighborhood poverty concentration. The latter difference is a function of the centers being located in the most disadvantaged neighborhoods and school areas. A summary of key attributes is the family risk index, which is the sum of the 8 aforementioned attributes coded dichotomously as risk factors. The preschool intervention and comparison groups experienced, on average, four and- a-half risks. Intergroup child welfare histories also were similar. Group comparisons for the original sample at preschool entry largely mirror those of the follow-up sample. The only difference was the gender balance and missing data on the risk indicators. Finally, comparisons using school-age and extended intervention groups showed a similar pattern of group comparability.

Intervention
Since the CPC intervention is described fully in previous reports, we provide a summary of the main features. Located in or close to elementary schools in the Chicago public school system, the CPC program provides educational and family-support services to children between the ages of 3 and 9 (preschool to second or third grade). Within a structure of comprehensive services similar to Head Start,
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 and individualized activities, frequent field trips, and play. Literacy experiences involving word analysis, oral communication, and listening skills are highlighted as described in the instructional activity guide. All teachers have bachelor’s degrees and are certified in early childhood education.

Each center is directed by a head teacher and two coordinators. The parent-resource teacher coordinates the family-support component. The paraprofessional school-community representative provides outreach to families. Major elements of the intervention include: low child-to-staff ratios in preschool (17:2), kindergarten (25:2), and the primary grades (25:2); an intensive parent program that includes parenting education, volunteering in the classroom, attending school events and field trips, further educational opportunities, and home visitation; and health and nutrition services, including screening and diagnostic services, speech therapy, meal services, and referrals by program nurses.

The preschool program is 3 hours per day, 5 days a week during the school year, and usually includes a 6-week summer program. After full-day or part-day kindergarten, school-age services are provided under the direction of the curriculum parent-resource teacher. The school-age intervention is open to any child in the school, either in first and second grade in 14 sites or first through third grade in six sites. The eligibility criteria for the intervention are (1) residence in a high-poverty (Title I) school area, (2) demonstration of educational need as assessed by a screening interview and staff outreach, (3) parent(s) agree to participate. Rates of participation of eligible children exceeded 80% of neighborhood families as the program was located in areas not served by other preschools, and most if not all families could not afford private child care. The high level of community participation helps ensure that findings are representative of eligible children rather than sample selective.

Outcome Measures

Educational Attainment. Four measures of attainment by age 23 years (mean 23.5 years, August 2003) were assessed. They derived from administrative records from colleges and universities in Illinois and other states, K-12 schools, and brief surveys of participants or family members. High school completion measured whether participants finished their high school education with an official diploma or received a GED or equivalent credential. All others were coded as “noncompleters.” College attendance and 4-year college attendance measured whether participants earned course credit for enrollment in a 2- or 4-year college program or in college awarding a bachelor’s degree. Highest grade completed was an ordinal indicator of educational attainment ranging from 6 to 16 (bachelor’s degree). Those completing high school or the GED were coded 12. Postsecondary experience was derived from the number of credits earned in college courses. Measures of parental educational attainment closely paralleled their children’s and came from several administrative sources (e.g., public health and aid records) and parent surveys by children’s age 17. These and other outcomes are described more fully elsewhere.

Economic Status and Self-Sufficiency

Several measures of economic well-being were assessed by age 24. Indicators of quarterly income were obtained from records of the Illinois Department of Employment Security and from the adult survey between ages 22-24. Full-time employment was measured from the adult survey and defined as 35 or more hours per week. To measure general socioeconomic status, a dichotomous variable indicated whether participants have ever attended college or have a stable work history defined as 4 quarters of earned income exceeding $3000 over ages 22-24. Parental employment (full or part-time) was measured from public aid and school system records, and surveys up to children’s age 17.

Public aid participation included enrollment in any of three major programs (TANF, Food
Stamps, and Medicaid) from ages 18-24 (1998-2004). The number of months of enrollment and cumulative prevalence were analyzed for sample members residing in Illinois in 1999 or later. We also assessed participation in the Food Stamp program. Data came from the Illinois Public Assistance Data Base maintained on behalf of the Illinois Department of Human Services. For parents of study participants, enrollment in each public aid program in Illinois was analyzed and covered children’s ages 9 to 18 (1989-1998).

Health Status and Behavior

Many indicators were analyzed for children and parents. Health insurance coverage, from either public (i.e., Medicaid) or private (employer-based) sources, was assessed between ages 22-24. Public insurance came from state-level Medicaid records and the adult survey. Private insurance coverage came from adult survey responses (e.g., “did employer provide insurance.”) and were supplemented with records from the Illinois Department of Employment Security.

Substance and tobacco use. Both were assessed on the adult survey. Substance use was a dichotomous variable indicating whether individuals reported any of the following: use of marijuana or harder drugs, drink alcohol more than once a day, have a substance use problem, or have received treatment. Both lifetime use and since age 16 were measured. Tobacco use was defined as currently smoking 1 or more cigarettes daily.

Disability status measured receipt of disability assistance (i.e., from SSDI) since age 18 from either the Illinois Department of Human Services or the adult survey. Finally, teenage parenthood was a dichotomous variable indicating if females gave birth to a child before age 18. Data were from the adult survey and public aid records.

For parents, two measures were included. Disability status was measured by receipt of disability assistance (e.g., SSDI) by child’s age 24 or a report of disability from parent surveys. Health problems were assessed by survey questionnaire. Parents indicated whether health problems prevented them from participating at their child’s school. This information was supplemented with participant reports in the adult survey that a parent had a serious illness in past years.

Mental Health

Depressive symptoms. Using the depression subscale of the Brief Symptom Inventory\textsuperscript{31}, participants rated on the age 24 survey how often in the past month they felt either depressed, helpless, lonely, life isn’t worth living, and sad (0 = not at all, 5 = almost every day). Scores from the 5 items were summed and ranged from 0 to 25. Higher scores indicated greater symptomology. A dichotomous variable also was analyzed indicating the frequent presence of 1 or more symptoms defined at levels ranging from a few times a month to almost every day.

Criminal Behavior

Arrest, conviction, and incarceration histories from ages 18-24 were obtained primarily from administrative records from county, state and federal agencies and supplemented with the adult survey. Arrests were measured dichotomously and with counts both overall and by whether charges were for violent offenses (e.g., aggrevated assault, armed robbery). Convictions were whether individuals were found guilty by the court. Incarceration measured whether individuals were sentenced to correctional institutions at the state or federal levels or to jails at the county level. Most records were from Illinois and other midwestern states, through December 9, 2004.

Child Maltreatment

This included the prevalence and number of substantiated (“indicated”) reports of child
abuse and neglect from ages 4 to 17. These were based on data from Child Protective Services of the Illinois Department of Children and Family Services and the Cook County Juvenile Court. Out of home placement indicated whether youth were placed outside the home in foster care, treatment foster care, or were adopted over the same age period primarily because of maltreatment histories. Children who left Chicago before age 10 with no service record were excluded from the study sample.

Statistical Analysis
Following many previous analyses in this project, intervention effects were estimated by multiple, probit, and negative binomial regression and were tested with many alternative models. The main analyses were summarized as follows. First, the effects of CPC preschool (1 or 2 years vs 0) and school-age (1-3 years vs 0) services were assessed simultaneously with 2 dummy variables. Second, the effects of CPC extended intervention were assessed in two ways. First with a dummy variable indicating participation for 4 to 6 years (preschool starting at age 3 or 4 and continuing to second or third grade) versus all other children, who received 0 to 4 years (Extended-1). This contrast assesses whether children who received the full program did better than others regardless of intervention experience. Analyses that included children with 1 to 4 years yielded similar results. The 4-6 year group also was contrasted with children who attended only CPC preschool and kindergarten, program and controlling for kindergarten achievement (Extended-2). This contrast assesses the added value of extended intervention above and beyond preschool and kindergarten. Notably, this is a conservative test of the effects of extended intervention.4, 10, 17

Findings are reported as adjusted coefficients and group differences controlling for the influence of the covariates. Measured between birth and age 3 from several sources (birth records, public aid, and family surveys), the covariates were gender of child, race/ethnicity, single-parent family status, parent educational attainment, parent employment, public aid status, eligibility for subsidized lunches, 4 or more children in the family, teen parenthood, and child welfare service history. Following established procedures, a dummy code for missing data on the risk indicators also was included. These have been common covariates in many previous studies. Analyses based on the family risk index instead of the individual indicators and the addition of program site dummy variables and other family factors yielded a similar pattern of results. Analyses of CPC extended intervention also included word analysis scores at the end of kindergarten.

Data were analyzed in STATA. Dichotomous variables were analyzed with probit regression. Count data (e.g., number of quarters with income over $3000) were analyzed by negative binomial regression. Continuous variables such as highest grade completed and quarterly income (natural log) were analyzed in multiple regression. To enhance interpretability, coefficients from probit and negative binomial regression were transformed to marginal effects. As found in previous reports, corrections for nonrandom attrition and clustering did not affect estimates nor did alternative analyses using propensity score and latent variable selection modeling. Given the social and economic importance of the outcomes, adjusted group differences were interpreted as program effects at the .10 probability level, although emphasis was given to differences at the .05 level. To test differential effects by subgroups, program interaction terms were tested for children’s gender, race/ethnicity, and low birth weight status, parent education attainment, employment, single-parent status, and overall family risk, and
length of preschool participation, curricula approach, and neighborhood poverty. Given their exploratory purpose, the statistical significance of subgroup effects was set at .05. However, emphasis was given to findings in which an overall main effect was detected.

RESULTS

Educational Attainment

Preschool participation. Relative to the comparison group and controlling for preprogram characteristics, the preschool group had significantly higher rates of high school completion (71.4% vs 63.7%, p = .01) and 4-year college attendance (14.7% vs 10%, p = .02). They also had more total years of completed education (11.7 vs 11.4 yrs, p = .006). Rates of overall college attendance were similar, which reflects the lack of differences in 2-year college attendance.

School-age participation. No group differences were found for any measure.

Extended program participation. Relative to fewer years of participation and controlling for preprogram characteristics, 4-6 year participants had higher rates of high school completion (73.9% vs 65.5%; p = .002), 4-year college attendance (16.7% vs 13.1%, p = .049) as well as more years of completed education (11.8 vs 11.5 yrs; p = .001). Relative to participation in preschool and kindergarten and controlling for kindergarten achievement, extended intervention was not associated with educational attainment (Extended-2).

Crime

Preschool participation. By age 24, the preschool group had significantly lower rates of incarceration (20.6% vs 25.6%, p = .033) and multiple incarcerations (7% vs 9%, p = .046) than the comparison group. They also were less likely to be found guilty of a crime (20.3% vs 24.7%, p = .063). No group differences were found on arrest, although preschool participants had consistently lower levels.

School-age participation. No group differences were found across measures.

Extended participation. Relative to fewer years of participation, the effects of extended intervention were limited to multiple incarcerations by age 24 (7.5% vs 9.7%, p = .019) and arrests for charges of violence (13.9% vs 17.9%, p = .038). No differences were found using preschool and kindergarten participants as the comparison group (Extended-2).

Economic Well-Being

Preschool participation. The preschool group was more likely than the comparison group to have a stable employment history or to have attended college by age 24 (54.1% vs 48.7%, p = .088). No other indicators showed significant differences, although the pattern of findings favored preschool participants. Analyses using TANF (among females) and Medicaid receipt yielded equivalent findings.

School-age participation. The program group had fewer months receiving any public aid (TANF, Food Stamps, or Medicaid) from age 18-24 (28.4 vs 33.9, p = .009) and they had lower rates of Medicaid participation. No other differences were found.

Extended intervention. In addition to lower rates of public aid receipt and Medicaid, extended intervention participants had higher rates of full time employment (42.7% vs 36.4, p = .039) and a stable employment history or college enrollment history (55.5 vs 50.3, p = .07). The employment difference was similar using the Extended-2 contrast.

Health Status and Behavior
Preschool participation. The preschool group had higher rates of health insurance coverage than the comparison group (70.2% vs 61.5%, p = .005). Rates of both private and public insurance coverage favored the program group. Rates of substance use and smoking were consistently lower for the program group but differences did not reach the level of statistical significance. Among females, no differences were found for teenage parenthood.

School-age participation. Two differences were found. The school-age group had a lower rate of disability by age 24 (4.9% vs 7.8%, p = .021). Among females, school-age participation was associated with a lower rate of teenage parenthood (27.4 vs 34.1%, p = 086).

Extended program participation. Program participation also was linked to lower teenage parenthood among females (26.7% vs 32.7%, p =.10). The extended program group was less likely to have an a disability as young adults (Extended-1; 4.4% vs 7.0%, p = .042). The program group also had a higher rate of private health insurance coverage (41.2% vs 33.2%, p = .005; not shown) even though the overall rate of insurance coverage was similar between groups. The Extended-2 contrast yielded no group differences.

Mental health

Preschool participation. Relative to the comparison group, the intervention group was less likely to have depressive symptoms (12.8% vs 17.4%, p = .057), defined as the frequent presence of 1 or more symptoms. No differences were found on the symptom scale.

School-age participation. No group differences were found.

Extended program participation. No differences were found for either program contrast although levels were generally lower for the program group.

Family and Parent Outcomes

Child maltreatment. As shown in Table 4, preschool was consistently associated with less maltreatment, and by age 17, participants had lower rates of out-of-home placement (4.7% vs 8.8%). Extended intervention showed a similar pattern relative to nonextended intervention (Extended-1). Preschool and extended intervention also linked to abuse and neglect prevention measured separately. For example, preschool participants had comparatively lower rates of abuse (6.8% vs 9.8%) and neglect (5.0% vs 10.8%).

Parent Well-Being. Similar to child outcomes, preschool participation was associated with higher parental educational attainment, including high school completion (72% vs 64.8%), highest grade completed (11.9 vs 11.6 yrs, p = .006), and 1 or more years of postsecondary education (30.4% vs 22.7%, p = .006). Extended intervention was linked to higher rates of school completion (Extended-1; 74.1% vs 66.6%, p = .007) and highest grade completed (extended-1; 11.9 vs 11.7 yrs, p = .006). School-age participation was not associated with parental outcomes.

Although CPC participants had generally higher rates of employment, only for Extended-1 were there significant group differences (56.8% vs 49.1%, p = .008). Apart from long-term Medicaid use (Extended-2, Table 4), no differences were found for public aid participation, either Food Stamps or AFDC/TANF.

Regarding health status, preschool participation was associated with lower rates of parental disability (4.8% vs 7.9%, p = .028) as measured by SSDI or self-reported impairment.

Differential Effects by Subgroups

We found limited evidence of differential intervention effects. Findings are summarized with an
emphasis on outcomes showing overall program effects (see Table 5).

**Program attributes.** Children who attended preschool programs rated (a) high in both child-initiated and teacher-directed instructional activities or (b) just high in child-initiated instruction had significantly lower rates of criminal conviction and incarceration compared to children in programs rated high in only teacher-directed instruction and low in both teacher directed and child initiated instruction. Groups high in child-initiated activities also had higher rates of high school completion (see Table 5).

Although 2-year preschool participants had generally higher levels of well-being, only for child maltreatment did they have significantly lower rates than 1-year participants (6.1% vs 11.4%, p = .004). Differences in public aid receipt, two or more arrests, and arrests for violence were marginally significant.

**Family demographics.** The effects of intervention were similar by parent education, economic status, age at child’s birth, family structure, and family risk status.

**Child characteristics.** Males experienced a greater preschool effect on high school completion (63.6% vs 48.2%, p < .001) than females (78.2% vs 79.2%, p = .787). No group differences by race/ethnicity and birth weight were detected.

**COMMENT**

This study makes several contributions to early childhood intervention and human development. First, as the most comprehensive investigation of an established large-scale program, participation in intervention was found to have broad effects on health and well-being in adulthood not apparent in previous studies. Preschool participants had comparatively higher rates of health insurance coverage and educational attainment, lower rates of criminal convictions and incarceration, and lower rates of depressive symptoms. They also had higher rates college enrollment or stable work experience and lower maltreatment. There were no differences in rates of teen parenthood, public aid receipt, and disability. That the impacts of intervention extend beyond educational performance are not surprising given the well documented links between education outcomes and adult health, mental health, and social behavior. Almost all previous long-term studies have focused on school performance and educational attainment, and have not followed participants into adulthood. Most noteworthy, this is the first study of early intervention linking participation to higher rates of insurance coverage, a byproduct of better school performance and attainment. Links to adult crime prevention have been documented, but not for large-scale prospective studies. Since expenditures for medical care and corrections systems are 30% of GDP, the potential cost savings to governments and taxpayers of early childhood prevention programs are considerable.

Second, we find continuing effects of intervention on educational attainment into adulthood. In addition to impacts on high school completion and years of completed education, preschool was associated with significantly higher rates of attendance in a 4-year college. This is particularly important given the increasing economic and health benefits experienced by college and postsecondary graduates relative to nongraduates and school dropouts. Nevertheless, by age 23 only a small fraction of program participants attended a 4-year college and so far higher levels of education do not result in significant differences in income, although program participants are more likely to be employed or attending college. Additional follow ups will provide a more complete assessment of socioeconomic status.

A third study contribution is that beneficial effects of intervention were found for parents...
of program participants. By the child’s age 18, parents of preschool participants had significantly higher rates of high school completion and postsecondary education. They also had comparatively lower rates of disability. Intergenerational effects of preschool programs have not been well documented yet many interventions including the CPC program provide family services. The observed effects are consistent with implemented program activities as substantial resources were available for parent training, education and personal development, and community participation. At the broader family level and extending on earlier studies, preschool intervention was linked to lower levels of both child abuse and neglect as well as out of home placements, which suggests that school-based early intervention is a promising avenue for maltreatment prevention.

Fourth, we found some evidence that program participation that continued into the primary grades was associated with greater adult well-being. Relative to less extensive intervention, participation for 4-6 years was associated with higher educational attainment, a higher rate of full-time employment, less need for public aid, lower levels of child maltreatment and violent crime, and greater parental well-being. Effect sizes were lower when kindergarten achievement was included as a covariate but these estimates remove the cognitive effects of preschool participation. Overall, these findings indicate the positive effects of length of intervention, and provide long-term empirical support for efforts to integrate services between preschool and third grade.

A final contribution of the study is that differential effects of intervention were investigated for program, child, and family characteristics. Due to small sample sizes, these effects have not been the focus of previous studies. Although for most outcomes the impact of intervention was similar for different subgroups, preschool participation was found to be more associated with high school completion for males than females. This is consistent with the 15-year follow-up study. While there were surprisingly few differences by length of preschool participation, children in preschool centers rated high in child-initiated activities had lower rates of incarceration and higher rates of high school completion as compared to children in centers rated low in child-initiated activities. These findings are consistent with previous studies examining school performance and delinquency, and suggest that preschool instructional activities can impact child health and development in adulthood.

Why does the CPC intervention promote enduring effects on health and well-being into adulthood? Four program elements seem paramount. First, a system of intervention is in place beginning at age 3 that continues to the early grades. This school-based system promotes stability in children’s learning environment which can provide smooth transitions to formal schooling. Today, most preschool programs are not integrated within public schools. A second key feature is that as a public-school program, all teachers have bachelor’s degrees and certification in early childhood education. They are compensated well and turnover is minimal. Well trained and compensated staff are common for programs demonstrating long-term effects yet are relatively absent in many early education programs. Third, instructional activities are responsive to all of children’s learning needs but special emphasis is given to literacy and school readiness through a diverse set of learning activities. From its inception, the program has emphasized the development of language and communication skills necessary for successful school performance. This is accomplished with a blend of literacy training, play, field trips, and whole-group and individualized activities. Finally, comprehensive family services provide many opportunities for positive learning experiences in school and at home. Because each center has a staffed parent
resource room and provides school-community outreach in addition to home visits, parental involvement is more intensive than in most other programs. Health services also are provided with referrals to community clinics and social services. Thus, the intervention shows that literacy education and family services can be integrated successfully.

Given the growing evidence of long-term positive effects of early intervention, the processes through which intervention leads to greater well-being are better understood.\textsuperscript{7, 27, 39} In the CPC program, there is evidence that long-term effects on educational attainment and crime are explained by three sets of factors: increased cognitive-scholastic skills for better school performance, positive family support behaviors, and positive school support experiences such as enrollment in higher quality schools.\textsuperscript{17, 27} Changes in motivation and socio-emotional adjustment are less associated with long-term intervention.\textsuperscript{27} These and related factors need to be investigated across a wider range of outcomes and interventions.\textsuperscript{17, 40}

We note two study limitations that may affect the interpretability of findings. First, some outcome measures were not assessed as completely as possible. Indicators of crime were obtained from administrative records of arrest and incarceration, and they represent the most serious and detectable behaviors. Alternatively, depressive symptoms were obtained from a brief self-report checklist and not clinical assessments, suggesting that intervention effects may be underestimated. They are only one indicator of mental health, however. Employment and income were measured prior to the completion of postsecondary education for many study participants and may have led to underestimation of effects on economic well-being. More stable and predictable economic profiles occur between ages 25 and 30. For example, between ages 19 and 24 the CLS sample increased their rate of high school completion by nearly fifty percent.\textsuperscript{19} Finally, outcomes for parents of program participants relied almost exclusively on administrative data with limited coverage of health behavior, crime, and mental health.

Second, although the generalizability of findings to existing state and federally funded early education programs is greater than most previous studies, the intervention effects are most likely to be reproduced in urban contexts serving relatively high concentrations of low-income children. Also, as a school-based intervention, the CPC program may not have the same effects in community-based settings. Recent findings from programs in more diverse contexts and with more diverse samples suggest positive effects can be achieved, thereby increasing generalizability.\textsuperscript{1, 11} Moreover, the CPC program has a long record of high-quality implementation and strong attention to educational enrichment and family services education. Programs without these attributes are less likely to show a similar pattern of results.

This study provides evidence that established early educational interventions can positively influence the adult life course in several domains of functioning. The scope and magnitude of intervention effects reveal not only the benefits to participants’ in fundamental indicators of health and well-being but the potential returns to society for investments in early educational programs.
REFERENCES


