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Early Childhood Education to Promote Health Equity: A Community Guide Economic Review

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Abstract

Context: A previous Community Guide systematic review found that early childhood education (ECE) programs improve educational, social, and health-related outcomes and advance health equity because many are designed to increase enrollment for high-risk students. This follow-up economic review examines how the economic benefits of center-based ECE programs compare with their costs.

Evidence Acquisition: Kay and Pennucci from the Washington Institute for Public Policy, whose meta-analysis formed the basis of the Community Guide effectiveness review, conducted a benefit–cost analysis of ECE programs for low-income children in Washington State. We performed an electronic database search using both effectiveness and economic key words to identify additional cost-benefit studies published through May 2015. Kay and Pennucci also provided us with national-level benefit-cost estimates for state and district and federal Head Start programs.

Evidence Synthesis: The median benefit-to-cost ratio from 11 estimates of earnings gains, the major benefit driver for three types of ECE programs (i.e., state and district, federal Head Start,

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and model programs), was 3.39:1 (interquartile interval [IQI]: 2.48 to 4.39). The overall median benefit-to-cost ratio from seven estimates of total benefits, based on additional components besides earnings gains, was 4.19:1 (IQI: 2.62 to 8.60) indicating that for every dollar invested in the program, there was a return of $4.19 in total benefits.

Conclusions: ECE programs promote both equity and economic efficiency. Evidence indicates there is positive social return on investment in ECE irrespective of the type of ECE program.

Keywords

early childhood education; efficiency; health equity; cost-benefit analysis; return on investment

Context

Center-based early education programs seek to improve cognitive or social development of children, with potential for lifelong benefits. Public funding for these programs is often justified to ensure that unequal endowments of resources do not create a barrier to accessing these developmental opportunities for children from lower socio-economic backgrounds. Redistributive tax and transfer policies sometimes present a dilemma for policy makers as interventions to promote equity may result in loss of resources due to administrative costs and negative incentives for work and investment. The trade-off between equity and economic efficiency for such policies is referred to in the literature as the leaky-bucket effect.[1] However, this trade-off is not a critical issue when the economic payoff from a tax-financed intervention substantially exceeds its costs. Early childhood education (ECE) programs, particularly those that target disadvantaged children from low-income families, are commonly advocated as interventions that can not only promote fairness and social justice, but also economic efficiency.[2]

As a well-established social determinant of health,[3] education can play a vital role in promoting equity and efficiency in public health.[4] The Community Preventive Services Task Force (CPSTF) recently recommended early childhood education (ECE) programs based on strong evidence of their effectiveness in improving educational outcomes associated with long-term health, and sufficient evidence of their effectiveness in improving social- and health-related outcomes.[5] The CPSTF also found that ECE programs promote health equity because many programs are designed to increase enrollment for high-risk students (i.e., from low-income families).[5] This paper is a follow-up review of economic evaluations of ECE programs.

Cost-effectiveness analyses based on intermediate outcomes have limited usefulness for this review. First, there is no standard practice in ECE literature to convert common intermediate outcomes to quality-adjusted life years (QALYs) gained, making it impossible to compare these cost-effectiveness estimates with the conventional threshold for cost per QALY gained. Additionally, among the numerous intermediate outcomes, none is comprehensive (e.g., cost per unit increase in standardized test scores, cost per additional high school graduate, cost per unit reduction in crime). Cost-benefit studies, on the other hand, provide a comparative assessment of costs and monetized benefits and enable estimation of the social return on investment. The focus of this paper is only on cost-benefit studies of ECE programs.

The published effectiveness review[6] described three general types of center-based ECE programs in the United States: state and district programs, the federal Head Start program, and model programs such as the Perry Preschool and Abecedarian programs. These programs typically focus on children from low-income, minority communities. This economic review, however, also considered universal preschool programs as they may improve educational and health equity by increasing enrollment of children from poor families. Parents often avoid programs based on income eligibility alone, to avoid the stigma and the anxiety about negative consequences for their children being associated with peers who are also poor.[7] The literature also cites possible benefits to disadvantaged children from exposure to students from different racial and social backgrounds. [8]

Evidence Acquisition

Search for Evidence

Cost–benefit and benefit-cost analyses are used interchangeably in professional practice. To evaluate effectiveness, the Community Guide used a published meta-analysis[9] by Kay and Pennucci from the Washington State Institute for Public Policy (WSIPP). Kay and Pennucci also conducted a benefit-cost model to estimate the expected return on investment in Washington State's Early Childhood Education and Assistance Program (ECEAP) and the odds that the investment would at least break even given the uncertainties in estimates. Because the wages and prices used to calculate benefits and costs are higher in Washington State than the national average, and states vary with respect to both program design and populations served, there were questions about generalizability of their findings to other states. Their cost–benefit analysis also did not include model programs. We performed an electronic database search with effectiveness and economic key words to identify additional cost–benefit studies published through May 2015 using the following sources: PubMed, ERIC, JSTOR, Medline, EconLit, and Google Scholar. Additionally, Kay and Pennucci provided us national-level benefit–cost estimates for state and district and federal Head Start programs (hereafter state/district programs and federal Head Start) following the model they used for their analysis of these programs in the Washington State (written communication, N. Kay, WSIPP, May 2015).

Inclusion Criteria

The intervention definition and inclusion criteria for this search were identical to those for the effectiveness review. [6] Additionally, the studies selected for the economic review focused only on cost-benefit analyses, which provide a convenient way to assess and compare returns from investment in ECE.

Economic Methods

Monetary values of costs and benefits were expressed in 2014 U.S. dollars using the Consumer Price Index from the U.S. Bureau of Labor Statistics.[10] To generate national-level benefit–cost estimates for state/district programs and federal Head Start, Kay and Pennucci used national estimates of labor market benefits, cost of grade retention and special education from Washington State, and the national average spending per student based on

funding per enrollee from 40 states that had state-funded pre-kindergarten programs in the school year 2011–2012.[11]

Evidence Synthesis

Body of Economic Evidence

The economic review included seven cost-benefit studies[9,12–17] all conducted in the U.S. Studies evaluated state/district programs (two studies[13,14]), the federal Head Start program (one study[15]), both state/district programs and federal Head Start (one study[9]) and model programs (three studies[12,16,17]). One study[13] conducted benefit–cost analysis for both full-day and half-day universal pre-K programs in Tulsa, Oklahoma. For each model program with different follow-up periods for participants, only the most recent study with the longest follow-up period was included. Authors of the study on state/district programs and federal Head Start conducted an additional analysis (written communication, N. Kay, WSIPP, May 2015) to generate national level benefit–cost estimates for these two types of ECE programs, the findings from which are also included in this economic review. The detailed economic evidence tables for all studies included in this review are available at: http://www.thecommunityguide.org/healthequity/education/supportingmaterials/SET-centerbasedprograms-econ.pdf.

Intervention Cost

To capture intervention costs, all studies used funding per participant rather than constructing cost estimates from a resource model for the program. The WSIPP study[9] subtracted the costs of additional child care subsidies that would have been paid had children not attended state pre-K or Head Start from the per capita funding level of each program to obtain estimates of relevant program costs.

National-level estimates for intervention costs for state/district programs and federal Head Start were based on 2011–2012 school year data from 40 states that had state and district programs during that year.[11] The mean funding per student on state/district programs was $5569 (range: $2094-$11,725). The funding per student in the Head Start programs in these 40 states varied from $6392 to $9757 with a mean of $7700. Although funding amounts are known to program implementers, none of the included studies provides a detailed breakdown of actual cost components. Staff salaries and benefits are expected to be the major cost driver, and costs may vary depending on enrollments and length of session, other operating expenses and capital outlays, and the quality of the programs.[18] The Head Start programs offer comprehensive health and nutrition services in addition to education and are more expensive relative to state/district programs. The WSIPP study[9] also reported that the Head Start program provided more classroom hours per year than ECEAP in Washington State (448 hours compared with 320 hours).

Intervention Benefits

All included studies reported incremental earnings gains associated with high school graduation modeled over the working age of program participants, which constituted the major benefit driver. Two studies[13,14] on state/district programs and one[15] on the federal

Head Start reported benefits from participants' earning gains only. The remaining studies estimated one or more of the following components to measure other short-, medium-, and long-term benefits:

- Increases in maternal employment and income
- Reductions in crime, welfare dependency, child abuse and neglect
- Savings from reduced grade retention and remedial education
- Healthcare cost savings
- Savings in child care costs

Table 1 reports benefits components estimated in each individual study across the three types of ECE programs and also lists the benefit driver(s). Some programs reported estimated dollar benefits of zero for some components.

The WSIPP study[9] of state/district programs and federal Head Start adjusted benefits by subtracting the deadweight cost of taxation—the welfare loss from the imposition of taxes required to pay for the programs. For federal Head Start, it also modeled potential benefits to secondary participants from preventing negative outcomes for the children of teen mothers, which included child abuse and neglect. Heckman et al.[16] incorporated alternative assumptions about deadweight cost of taxation in their benefit–cost analysis of the Perry Preschool program. For the Abecedarian and Chicago Child-Parent Center programs,[12,17] postsecondary education costs were deducted from total benefits. Also, in the Abecedarian study, there was no impact on crime because the baseline crime rate in the broader community was low. A more recent study of the Abecedarian program[19] reported a significantly lower prevalence of risk factors for cardiovascular and metabolic diseases for treatment group children when they were in their mid-30s. The bundled nature of treatment, which included access to pediatric care and proper nutrition in early years and improved cognitive and noncognitive skills, did not allow the authors to examine the source of these treatment effects. More importantly though, the authors did not monetize these health benefits found in their longitudinal follow-up of program participants.

Value of earnings gains per child ranged from $14,459 based on national estimates of the impacts of the federal Head Start program to $147,359 for the Abecedarian model program in North Carolina.[12] The latter estimate included maternal income, earnings gains for future generation through maternal employment and income, and income for participating children as adults. Total benefits across all three types of ECE programs ranged from $23,150 to $208,283 per child.

Cost–Benefit Analyses

Tables 2, 3, and 4 provide cost, benefit, and cost–benefit estimates respectively for state/district, federal Head Start, and model programs. All future costs and benefits for most studies were discounted at 3%.

For state/district programs, cost per child ranged from $4086 for the Oklahoma/Georgia preschool to $9118 for the Tulsa full-day preschool. The WSIPP report[9] provided both

earnings gains and total benefit estimates from Washington State's ECEAP. Bartik et al.[13] and Cascio and Schanzenback[14] provided only benefit estimates from earnings gains for the universal preschool programs. Unlike Bartik et al., who used a 3% discount rate, Cascio and Schanzenback used a 3.4% discount rate but assumed a 1.9% real productivity growth rate per year. The benefit-cost estimates from all studies show positive net benefits and a positive return on investment (ROI) that ranged from 3.06 to 5.90, indicating a return of approximately $3 to $6 respectively for every dollar invested in these programs.

For federal Head Start programs, the WSIPP extended model (written communication, N. Kay, WSIPP, May 2015) and the Duncan study[15] provided national estimates of benefit–cost ratios whereas the WSIPP study[8] presented benefit–cost estimates for the federal Head Start program in Washington State. Intervention cost per child ranged from $7982 for the WSIPP extended study to $9173 in the Duncan study. Based on earnings gains alone, the benefit-to-cost ratios ranged from 1.58:1 to 2.51:1. The ratio was lowest for the Duncan study both because its cost per child was higher and it underestimated earnings gains by using test score results from only two studies on federal Head Start programs. This benefit-cost ratio would be about 50% higher based on the average earnings impact from the 33 studies in a meta-analysis of Head Start programs.[20]

Model programs were quite different from the state/district programs and federal Head Start. They targeted high-risk minority populations. They were more intensive in delivery and of longer duration, and, therefore, tended to be more expensive. Intervention cost ranged from $9719 for the Chicago Child-Parent Center program to $83,530 for the North Carolina Abecedarian program. The Abecedarian program was particularly expensive as it provided education in a year-round child care program operating up to 10 hours per day and serving children from birth to 5 years. All three studies of model programs presented program benefits in terms of both earnings gains and total benefits and reported positive net benefits and benefit-cost ratios that exceeded 1. The Chicago Child-Parent Center program recorded the highest return on investment of $10.80 per dollar invested in the program. The cost per child in this large scale federally funded program was substantially lower than that in the two other model programs and was the primary factor contributing to its highest benefit-cost ratio.

Summary and interpretation of findings

Four[13–16] studies included in this review were used in a recent analysis[20] by the President's Council on Economic Advisers to describe the economic returns on investment in ECE programs. Economic evidence indicates there is a positive return on investment in early childhood education. Future earnings gains for program participants, reported in all included cost–benefit analyses, constituted a major benefit driver that alone exceeded program costs. The median benefit-to-cost ratio from 11 estimates of earnings gains was 3.39:1 (interquartile interval [IQI]: 2.48 to 4.39). Additional components of intervention benefits considered the perspectives of state and local governments, parents, tax payers, and society (including beneficial "spillover" effects associated with increases in education). The median benefit-to-cost ratio from seven estimates of total benefits was 4.19:1 (IQI: 2.62 to 8.60),

indicating that for every $1 invested in the program, there was a return of $4.19 in total benefits.

In general, the benefit-cost ratios were highest for model programs, though all three types of ECE programs yielded positive returns on investment. Lack of standardization in benefit-cost analysis methods can make it hard to compare benefit-cost estimates across programs.[21] Beyond proof of the principle that all these ECE interventions can generate positive economic returns, it is difficult to make apple-to-apple comparison of benefit-cost ratios across programs because of differences in methodologies, population characteristics, and the number of estimated benefit components. The Heckman et al. study[16] on the Perry Preschool program explained how different valuation approaches for specific outcomes can result in difference benefit-cost ratios, even for the same program. For model programs, the variation in program design and identifiable programmatic differences appear to have had large impacts on program outcomes.

Discussion

Cost

In estimating the benefit-cost ratios for different types of ECE interventions, it is essential to ensure that cost based on funding per child captures all relevant sources of funding including federal, state, local, and even private sector contributions, including parent fees. The federal Head Start program, for example, is required to have a 20 percent match from local grantees. It also gets state supplemental funds to improve quality in many places, and other resources. Head Start's actual cost per child thus is at least 1.2 times the federal funding per child, implying that benefit-cost ratios based solely on federal funding need to be deflated by at least 83% to obtain realistic benefit-cost ratios for this program.

Modeled versus actual benefits

The economic benefits of state/district programs and federal Head Start used modeling, and are subject to uncertainties depending on assumptions and parameter values used in the models. For the model programs, benefits were confirmed by longitudinal follow-up of students into their adulthood. Tracking the students in large-scale public programs over time is difficult. Any randomized experiment will require cooperation from parents and subjects over a long period of time[22]; the follow-up problem could be reduced, however, if individual identifiers were connected to administrative data collected by governmental education, health, labor, and taxation departments. An alternative is to use retrospective information from individuals participating in existing large-scale, longitudinal data sets to compute the benefits of such programs.[22]

Perspectives

Although economic evidence suggests that ECE programs offer substantial economic payoff and are a good societal investment, benefits vary depending on the specific perspectives of different stakeholders. Parents of children participating in these programs may reap immediate benefits through childcare cost savings and opportunities for maternal employment and income, if programs offer sufficient hours to be practical sources of child

care. Government health care programs and private health insurers could benefit from realized healthcare cost savings throughout a participant's life time. The primary beneficiaries—the children participating in these programs—ultimately benefit the society by being more productive in the labor force during their adulthood and contributing to taxes. State and local governments may realize benefits through reduction in welfare payments and crime over time, but may be concerned that they have to bear intervention costs immediately. The upfront costs of implementing the programs may constitute a barrier for program adoption, particularly when major benefits are downstream and only realized in the long term.

Impacts on economic growth and government budget

With their children in ECE programs, parents have more time to work; this additional work will increase gross domestic product (GDP). However, GDP may decline when tax-financed programs create disincentives for work and investment. Also, as preschool program participants stay in school longer than previous cohorts, this will reduce GDP initially. However, when the ECE participants enter the labor force, GDP will increase substantially because they are more productive and are expected to remain employed and live longer than those who are less educated. A study[23] that embedded estimates of the effects from the Abecedarian and the Perry Preschool programs in a growth model of the U.S. economy found that after an initial decline, GDP will grow continually, reaching 1.2% and 4.4% respectively above the baseline growth rates adopted from the Congressional Budget Office, 75 years after the start of the programs. Assuming a 3% discount rate, the authors also estimated that both programs would recover more than three-fourths of their costs within this 75-year budget window.

Evidence Gaps

Information is lacking on the costs and benefits of additional components (meals, health care, social services, parental engagement, and other services) that are sometimes offered with ECE programs. Information is also limited on costs/benefits for components of program quality, including class size, professional development, and curriculum. Also, net benefits and benefit-cost ratios are underestimated when studies do not look beyond improvement in academic test scores, neglecting benefits from improvements in other behaviors that reduce the costs of crime and physical and mental health problems. Moreover, studies do not incorporate many intangible benefits, including those from reductions in crime, especially murders and violent crimes where such benefits are typically larger than the tangible benefits.[21] Finally, as long as direct measures of adolescent and adult outcomes in state/district and federal Head Start programs are lacking, it is not clear to what extent the actual long-term benefits of these programs would approximate modeled benefits. In this context, extensive prospective data collection from large-scale public ECE programs can bolster confidence about the magnitude of economic benefits achievable through these programs.

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Points of view are those of the authors and do not necessarily reflect those of CDC.

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Table 1:

Estimated intervention benefit components for the 3 program types

Study	Earnings gain		Children	Crime reduction	Lower welfare use	Remedial education savings	Improved health	Child abuse and neglect	Child care cost savings
	Maternal	Intergene-rational							
State and District Programs									
Kay et al. (2014)			✓*	✓		✓	✓		
Kay et al. (2015)[a]			✓*	✓		✓	✓		
Cascio et al. (2013)			✓*						
Bartik et al. (2012) Full-day Program			✓*						
Bartik et al. (2012) Half-day Program			✓*						
Federal Head Start									
Kay et al. (2014)			✓*	✓		✓	✓	✓	
Kay et al. (2015)[a]			✓*	✓		✓	✓	✓	
Duncan (2013)			✓*						
Model Programs									
Barnett et al. (2007)	✓*	✓	✓*	✓	✓	✓	✓*		✓*
Heckman et al. (2010)	✓		✓*	✓*	✓	✓			✓
Reynolds et al. (2011)			✓*	✓*		✓	✓	✓	✓

*Major benefit driver

[a]Written communication, N. Kay, WSIPP, May 2015

Table 2:

Summary of Cost–Benefit Studies for State and District Programs

Author (Year)	Intervention	Cost per child	Intervention Benefit		Benefit–Cost Ratio		Net Benefit
			Earnings only	Total benefit	Earnings only	Total benefit	
Kay et al. (2014)	WSIPP ECEAP	$7191 *	$26,791	$30,119	3.73	4.19	$22,928
Kay et al. (2015) [a]	WSIPP National Estimates	$5719	$25,128	$30,491	4.39	5.33	$24,771
Cascio et al. (2013)	OK/GA Pre-school	$4086	$24,094	-	5.90	-	$20,008
Bartik et al. (2012)	Tulsa, Full-day	$9118	$27,897	-	3.06	-	$18,779
Bartik et al. (2012)	Tulsa, Half-day	$4559	$16,683	-	3.67	-	$12,124

* Adjusted by the difference in state-subsidized childcare subsidies between program and non-program students

[a] Written communication, N. Kay, WSIPP, May 2015

Table 3:

Summary of Cost–Benefit Studies for Federal Head Start Programs

Author (Year)	Intervention	Cost per child	Intervention Benefit		Benefit-Cost Ratio		Net Benefit
			Earnings only	Total benefit	Earnings only	Total benefit	
Kay et al. (2014)	WSIPP l Head Start in Washington State	$8830	$21,921	$23,150	2.48	2.62	$14,320
Kay et al. (2015)[a]	WSIPP Head Start National Estimates	$7982	$20,022	$22,392	2.51	2.81	$14,410
Duncan et al. (2010)	National Head Start	$9173	$14,459	-	1.58	-	$5,286

[a] Written communication, N. Kay, WSIPP, May 2015

Table 4:

Summary of Cost–Benefit Studies for Model Programs

Author (Year)	Intervention	Cost per child	Benefit per child		Benefit-Cost Ratio		Net Benefit
			Earnings only	Total benefit	Earnings only	Total benefit	
Barnett, et al., 2007	North Carolina Abecedarian	$83,530	$147,359	$208,283	1.76	2.49	$124,753
Heckman, et al. (2010)	Perry Pre-school	$20,854	$91,606	$179,446	4.39	8.60	$158,592
Reynolds et al. (2011)	Chicago Child-Parent Center	$9719	$32,933	$105,294	3.39	10.83	$95,575