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

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ABSTRACT

Context: A recent 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 children. 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 State 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 3 types of ECE programs (ie, state and district, federal Head Start, and model programs), was 3.39:1 (interquartile interval [IQI] = 2.48-4.39). The overall median benefit-to-cost ratio from 7 estimates of total benefits, based on all benefit components including earnings gains, was 4.19:1 (IQI = 2.62-8.60), 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. The adoption of a societal perspective is crucial to understand all costs and benefits of ECE programs regardless of who pays for the costs or receives the benefits.

KEY WORDS: cost-benefit analysis, early childhood education, efficiency, health equity, return on investment

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Context

Center-based early education programs seek to improve cognitive and social development of children, with potential for lifelong benefits. Public funding for these programs is often justified to ensure that unequal family income and wealth do not create a barrier to accessing these developmental opportunities for children from lower socioeconomic 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 promote

not only 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 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 (ie, from low-income families).[5] This article 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 life-years (LYs) or quality-adjusted life years (QALYs) gained, making it impossible to obtain cost-effectiveness estimates that can be compared with the conventional cost-effectiveness thresholds such as $50 000 per LY or QALY gained. In addition, among the numerous intermediate outcomes, none is comprehensive (eg, cost per unit increase in standardized test scores, cost per additional high school graduate, cost per unit reduction in crime). More importantly, many intermediate outcomes have already been linked to monetary benefits in existing cost-benefit analyses of ECE programs. Since cost-benefit estimates are easy to understand and they provide a convenient means to calculate the return on investment (ROI), this article focuses only on cost-benefit studies of ECE programs.

The published effectiveness review[6] described 3 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 anxiety about negative consequences for their children when associating 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 by Kay and Pennucci[9] from the Washington State Institute for Public Policy (WSIPP). Kay and Pennucci also developed a benefit-cost model to estimate the expected ROI 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. In addition, Kay and Pennucci gave us national 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 (N. Kay, WSIPP, written communication, May 2015).

Inclusion criteria

The intervention definition and inclusion criteria for this search were identical to those for the effectiveness review.[6] In addition, the studies selected for the economic review focused on cost-benefit analyses, which provided a convenient way to assess and compare ROIs in ECE.

Economic methods

Monetary values of costs and benefits were expressed in 2014 US dollars using the Consumer Price Index from the US Bureau of Labor Statistics.[10] To generate national benefit-cost estimates for state/district programs and federal Head Start, Kay and Pennucci used national estimates of labor market benefits, school system 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 prekindergarten (pre-K) programs in the school year 2011-2012.[11]

Evidence Synthesis

Body of economic evidence

The economic review included 7 cost-benefit studies,[9,12-17] all conducted in the United States. Studies evaluated state/district programs (2 studies[13,14]), the federal Head Start program (1 study[15]), both state/district programs and federal Head Start (1 study[9]), and model programs (3 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 (N. Kay, WSIPP, communication, May 2015) to generate national-level benefit-cost estimates for these 2 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. To obtain estimates of relevant program costs, 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.

National 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. None of the included studies provided 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 than 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).

For state/district programs, cost per child ranged from $4086 for the Oklahoma/Georgia preschool to $9118 for the Tulsa full-day preschool. For federal Head Start programs, intervention cost per child ranged from $7982 for the WSIPP extended study to $9173 in the Duncan et al study.[15] 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 per child 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.

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 1 study[15] on federal Head Start reported benefits from participants' earnings gains alone. The remaining studies also estimated 1 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 by the participating child;
- Savings from reduced grade retention and remedial education;
- Health care cost savings; and
- Savings in child care costs.

Table 1 reports benefit components estimated in each individual study across the 3 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

TABLE 1
Estimated Intervention Benefit Components for the 3 Program Types

Author (Year)	Earnings Gain			Crime Reduction	Lower Welfare Use	Remedial Education Savings	Improved Health	Child Abuse and Neglect	Child Care Cost Savings
	Maternal	Intergenerational	Children						
State and district programs									
Kay and Pennucci (2014)			√[a]	√		√	√		
Kay (2015)[b]			√[a]	√		√	√		
Cascio and Schanzenbach (2013)			√[a]						
Bartik et al (2012)									
Full-day program			√[a]						
Half-day program			√[a]						
Federal Head Start									
Kay and Pennucci (2014)			√[a]	√		√	√	√	
Kay (2015)[b]			√[a]	√		√	√	√	
Duncan et al (2010)			√[a]						
Model programs									
Barnett and Masse (2007)	√[a]	√	√[a]	√	√	√	√[a]		√[a]
Heckman et al (2010)	√		√[a]	√[a]	√	√			√
Reynolds et al (2011)			√[a]	√[a]		√	√	√	√

Abbreviation: WSIPP, Washington State Institute for Public Policy.
[a]*Major benefit driver.*
[b]*N. Kay (WSIPP, communication May 2015).*

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 resulted in improved cognitive and noncognitive skills, did not allow the authors of this study to examine the source of these treatment effects. More important though, the authors did not monetize these health benefits found in their longitudinal follow-up of program participants so that benefit estimates are likely to be conservative.

The WSIPP report[9] included both earnings gains and total benefit estimates from ECEAP and federal Head Start programs in Washington State, a practice that was followed by Kay and Pennucci in their estimation of the national-level benefits for these 2 types of programs. Bartik et al[13] and Cascio and Schanzenbach[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 Schanzenbach used a 3.4% discount rate but assumed a 1.9% real productivity growth rate per year. All 3 studies of model programs presented program benefits in terms of both earnings gains and total benefits.

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 3 types of ECE programs ranged from $22 392 to $208 283 per child.

Cost-benefit analyses

Tables 2-4 provide cost, benefit, and benefit-cost 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, the benefit-cost estimates from all studies show positive net benefits and a 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, the WSIPP extended model (N. Kay, WSIPP, communication, May 2015) and the Duncan et al study[15] provided national estimates of benefit-to-cost ratios whereas the WSIPP study[9] presented benefit-cost estimates for the federal Head Start program in Washington State. On the basis of earnings gains alone, the benefit-to-cost ratios ranged from 1.58:1 to 2.51:1. The ratio was lowest for the Duncan et al[15] study both because its cost per child was higher and it underestimated earnings gains by using test score results from only 2 studies on federal Head Start programs. This benefit-to-cost ratio would be about 50% higher based on the average earnings impact from the 33 studies used in a meta-analysis of Head Start programs.[20]

All 3 studies of model programs reported positive net benefits and benefit-to-cost ratios that exceeded 1. The Chicago Child-Parent Center program recorded the highest ROI of $10.83 per dollar invested in the program. The cost per child in this large-scale

TABLE 2
Summary of Cost-Benefit Studies for State and District Programs

			Intervention Benefit		Benefit–to-Cost Ratio		
Author (Year)	Intervention	Cost per Child	Earnings-Only	Total Benefit	Earnings-Only	Total Benefit	Net Benefit
Kay and Pennucci (2014)	WSIPP ECEAP	$7191[a]	$26 791	$30 119	3.73	4.19	$22 928
Kay (2015)[b]	WSIPP National estimates	$5719	$25 128	$30 491	4.39	5.33	$24 772
Cascio and Schanzenbach (2013)	Oklahoma/Georgia preschool	$4086	$24 094	…	5.90	…	$20 008
Bartik et al (2012)	Tulsa, full-day	$9118	$27 897	…	3.06	…	$18 779
	Tulsa, half-day	$4559	$16 683	…	3.66	…	$12 124

Abbreviations: ECEAP, Early Childhood Education and Assistance Program; WSIPP, Washington State Institute for Public Policy.
[a] Adjusted by the difference in state-subsidized child care subsidies between program and nonprogram students.
[b] N. Kay (WSIPP, communication, May 2015).

TABLE 3
Summary of Cost-Benefit Studies for Federal Head Start Programs

Author (Year)	Intervention	Cost per Child	Intervention Benefit		Benefit-to-Cost Ratio		Net Benefit
			Earnings-Only	Total Benefit	Earnings-Only	Total Benefit	
Kay and Pennucci (2014)	WSIPP I Head Start in Washington State	$8830	$21 921	$23 150	2.48	2.62	$14 320
Kay (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

Abbreviation: WSIPP, Washington State Institute for Public Policy.
[a] *N. Kay (WSIPP, communication, May 2015).*

federally funded program was substantially lower than that in the 2 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 ROIs in ECE programs. Economic evidence indicates a positive social ROI in early childhood education across all 3 types of ECE programs. 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] = 2.48-4.39). Additional components of intervention benefits considered the perspectives of state and local governments, parents, taxpayers, and society (including beneficial "spillover" effects associated with increases in education). The median benefit-to-cost ratio from 7 estimates of total benefits was 4.19:1 (IQI = 2.62-8.60), indicating that for every $1 invested in the program, there was a return of $4.19 in total benefits.

In general, the benefit-to-cost ratios were highest for model programs. 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-to-cost ratios across programs because of differences in methodologies, population characteristics, and the number of estimated benefit components. The Heckman et al[16] study on the Perry Preschool program explained how different valuation approaches for specific outcomes can result in different benefit-to-cost ratios even for the same program. For model programs, the variation in program design and identifiable programmatic differences seem to have large impacts on program outcomes.

Discussion

Cost

In estimating the benefit-to-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

TABLE 4
Summary of Cost-Benefit Studies for Model Programs

Author (Year)	Intervention	Cost per Child	Benefit per Child		Benefit-to-Cost Ratio		Net Benefit
			Earnings-Only	Total Benefit	Earnings-Only	Total Benefit	
Barnett and Masse (2007)	North Carolina Abecedarian	$83 530	$147 359	$208 283	1.76	2.49	$124 753
Heckman, et al (2010)	Perry Preschool	$20 854	$91 606	$179 446	4.39	8.60	$158 592
Reynolds et al (2011)	Chicago Child-Parent Center	$9 719	$32 933	$105 294	3.39	10.83	$95 575

parent fees. The federal Head Start program, for example, is required to have a 20% match from local grantees. It also gets state supplemental funds to improve quality in many places, as well as other resources. Head Start's actual cost per child thus is at least 1.2 times the federal funding per child, implying that benefit-to-cost ratios need to be deflated to 83% of the values based solely on federal funding in order to obtain realistic benefit-to-cost ratios for this program.

Modeled versus actual benefits

The economic benefits of state/district programs and federal Head Start were developed through modeling that are subject to uncertainties depending on assumptions and parameter values used. For the model programs, benefits were confirmed by longitudinal follow-up of students into their adulthood. Tracking 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]

Health benefits from ECE programs

ECE can serve as a powerful policy lever for improving public health and longevity by reducing the growing health disparities by educational attainment.[23] Existing studies of ECE programs either do not monetize the health benefits from ECE programs or do so only partially by monetizing some health benefits. A full and comprehensive assessment of the monetary value of all health benefits resulting from ECE programs can strengthen the economic case for ECE as a public health investment.

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 child care 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 health care cost savings throughout a participant's lifetime. The primary beneficiaries are the children participating in these programs, as they benefit from better jobs and higher earnings throughout their employment years and lifelong better health. They also benefit 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 the 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. Finally, schools and the broader educational system are an important stakeholder in the ECE debate. Significant resources are already being spent to close achievement gaps in schools, reduce school failures, and improve college readiness. Not only do ECE programs lower costs associated with grade retention and the provision of special education services in schools but they also may alleviate the need for fragmented school prevention programs to reduce truancy, school violence, and risky health behaviors during school years. These potential cost savings throughout K-12 education can impact the net costs of implementing the ECE programs as part of a broader educational system.

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[24] that embedded estimates of the effects from the Abecedarian and Perry Preschool programs in a growth model of the US economy found that after an initial decline, GDP would 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.

Implications for Policy & Practice

- Early childhood is a sensitive formative period in the growth and development of cognitive, social, emotional, and physical health competencies. While the actual rate of return from ECE programs may vary widely depending on the type and characteristics of the programs, the key implication for policy makers is that ECE programs yield a positive rate of ROI and promote educational and health equity.
- The time required for benefits to offset intervention cost and the mismatch between who receives the primary benefits and who pays for the upfront program costs may explain the lack of greater support for ECE programs. The adoption of a societal perspective is crucial in this context to calculate the rate of ROI.
- Practitioners also need to be aware that funding considerations should take into account quality standards sufficient to ensure effectiveness of ECE programs.

Evidence gaps

Information is lacking on the costs and benefits of program 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-to-cost ratios are underestimated when studies do not look beyond improvement in academic test scores, neglecting benefits from improvements in noncognitive skills that positively impact physical and mental health. 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 from 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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