

Social Determinants of Health: Center-Based Early Childhood Education

Task Force Finding and Rationale Statement

Table of Contents

Context.....	2
Intervention Definition	2
Task Force Finding.....	2
Rationale	2
Basis of Finding	2
Applicability and Generalizability Issues.....	6
Data Quality Issues.....	6
Other Benefits and Harms	6
Economic Evidence	6
Considerations for Implementation.....	7
Evidence Gaps	7
References	8
Disclaimer.....	8

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Task Force Finding and Rationale Statement

Context

Children in low-income families often experience delays in language and other development by the age of three. Compensating for these delays before children begin regular schooling can be critical to providing them with equal opportunities for lifelong employment, income, and health. In 2010, less than half of children in families in the lowest income quartile were enrolled in center-based early childhood education programs (Duncan & Magnuson 2013).

Intervention Definition

Center-based early childhood education programs (ECE) aim to improve the cognitive or social development of children ages 3 and 4 years.

- Programs **must** include an educational component that addresses one or more of the following: literacy, numeracy, cognitive development, socio-emotional development, and motor skills.
- Programs **may** offer additional components including recreation, meals, health care, parental supports, and social services. Some programs may enroll children before they are 3 years of age.

Many ECE programs target children from low-income families. These include state and district programs, the federal Head Start program, and model programs such as the Perry Pre-School and Abecedarian programs (Campbell et al., 2002; Schweinhart et al., 2005).

Task Force Finding (March 2015)

The Community Preventive Services Task Force recommends early childhood education (ECE) programs based on strong evidence of effectiveness in improving educational outcomes that are associated with long-term health and sufficient evidence of effectiveness in improving social- and health-related outcomes. When provided to low-income or racial and ethnic minority communities, early childhood education programs are likely to reduce educational achievement gaps, improve the health of low-income student populations, and promote health equity.

Economic evidence indicates there is a positive return on investment in early childhood education. The benefits from students' future earnings gains alone exceed program costs.

Rationale

Basis of Finding

The Task Force finding is based on evidence from a 2014 meta-analysis analysis of 49 studies of center-based preschool programs for low-income children ages 3 to 4 years (Kay & Pennucci, 2014). The report was published by the Washington State Institute for Public Policy (WSIPP) – a non-partisan research institution that evaluates programs for the Washington State legislature to inform policy decisions. The meta-analysis (search period through November 2013) met Community Guide systematic review standards in terms of intervention definition, outcome assessment, study design and execution evaluation, and synthesis of effect estimates. To maximize validity, researchers only included studies with high quality design and good quality of execution. The report included educational outcomes (i.e., standardized test scores, high school graduation, grade retention, and assignment to special education) as well as social- and health-related outcomes (i.e., crime, teen birth, self-regulation, and emotional development). Separate analyses were conducted for state and district programs (combined), the federal Head Start program, and model programs, such as the Perry Preschool and Abecedarian programs (Table 1).

Table 1: Reported Characteristics of Three Types of Center-Based Early Childhood Education Programs

	State and District Preschool	Head Start	Model Programs
Student ages	3 to 4 years (most students were 4 years old)	3 to 4 years	Varied by program; some served birth to 5 years and others enrolled students aged 3 to 4 years
Income limits	Often low-income	Low-income	Low-income
Screening/care provided	Health screening	Health, vision, and dental screening	Health care (in some programs)
Other services provided	Varied	Family support services	Home visits
Teacher training	Most had at least an associate degree in early childhood education	57% of state programs required a bachelor's degree	"Highly trained"
Instruction hours per year	320 to >1080 hours	57% of programs full-day–1170 hours. 74% of programs followed school calendar	Varied
Quality score ^A	7.4	8	10
Annual cost per child (average estimated in 2012 U.S. dollars)	\$6,305	\$9,332	Not reported

^ASource: National Institute for Early Education Research, www.nieer.org

In the studies included in the meta-analysis, some outcomes were assessed shortly following program completion, and others were assessed when students were older (Table 2).

Table 2. Educational, Social, and Health-Related Outcomes

Outcome	Mean age at follow-up (years)	Standardized Mean Difference (95% CI)	Magnitude of effect meaningful?	Consistent across body of evidence?
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Outcome	Mean age at follow-up (years)	Standardized Mean Difference (95% CI)	Magnitude of effect meaningful?	Consistent across body of evidence?
Test scores (27 studies)	4.0	0.29 (0.23, 0.34)	Yes	Yes
High school graduation (7 studies)	20.3	0.20 (0.07, 0.33)	Yes	Yes
Grade retention (12 studies)	13.7	-0.23 (-0.49, -0.07)	Yes	Yes
Assignment to special education (6 studies)	15.5	-0.28 (-0.49, -0.08)	Yes	Yes
Self-Regulation (5 studies)	4.0	0.21 (0.14, 0.28)	Yes	Yes
Emotional development (7 studies)	4.0	0.04 (-0.05, 0.12)	No	No
Crime (5 studies)	24.3	-0.23 (-0.45, 0.05)	Yes	No
Teen Birth (3 studies)	18.00	-0.46 (-0.92, 0.0)	Yes	No

All effects were in a favorable direction for each program type (for which they were evaluated), but not all effects were statistically significant at the 0.05 level.

- Standardized achievement tests – significant beneficial effects were found for all three program types
 - State and district: 0.32 SD (95%CI 0.25, 0.38)
 - Head Start: 0.17 SD (95%CI 0.12, 0.23)
 - Model programs: 0.57 SD (95%CI 0.24, 0.81)
- High school graduation – a statistically significant positive effect was found for Head Start programs, but not for the other program types
 - State and district: 0.23 SD (95%CI -0.04, 0.50)

- Head Start: 0.18 SD (95%CI 0.03, 0.33)
- Model programs: -0.46 SD (95%CI -0.96, 0.03)
- Grade retention –non-significant beneficial effects were found for all program type
 - State and district: -0.39 SD (95%CI -0.26, 0.19)
 - Head Start: -0.08 SD (95%CI -0.34, 0.19)
 - Model programs: -0.46 SD (95%CI -0.96, 0.03)
- Assignment to special education – non-significant favorable effects were found for state and district and model program types, and this outcome was not evaluated for Head Start
 - State and district: -0.12 SD (95%CI -0.51, 0.04)
 - Model programs: -0.47 SD (95%CI -0.99, 0.05)
- Crime–non-significant favorable effects were found for all program types
 - State and district: -0.25 SD (95%CI -0.59, 0.09)
 - Head Start: -0.18 SD (95%CI -0.71, 0.35)
 - Model programs: -0.32 SD (95%CI -0.74, 0.10)
- Teen birth rates – no studies of state and district programs evaluated this outcome, and non-significant favorable effects were found for the other two program types
 - Head Start: -0.47 SD (95%CI -1.04, 0.11)
 - Model programs: -0.44 SD (95%CI -1.22, 0.33)
- Self-regulation – a statistically significant positive effect was found for state and district programs; a non-significant benefit was shown for Head Start, and no studies of model programs evaluated this outcome
 - State and district: 0.23 SD (95%CI 0.12, 0.33)
 - Head Start: 0.16 SD (95%CI -0.09, 0.41)
- Emotional development – effects were negligible and statistically non-significant for state and district programs and Head Start programs, and no studies of model programs evaluated this outcome
 - State and district: 0.04 SD (95%CI -0.08, 0.17)
 - Head Start: 0.03 SD (95%CI -0.07, 0.13)

The meta-analysis assessed the persistence of program effects on standardized achievement tests in combination with outcomes such as IQ. Among several models evaluated, the statistical model that best fit the long term data was a power function in which there was a rapid decrease of effectiveness following the conclusion of the program, followed by a more gradual decline in later years. An assessment of the difference in rates of decline in achievement versus IQ indicated no statistical difference (N. Kay, personal communication, November 12, 2014). When program participants were 9 years old, there remained a statistically significant program benefit; the power curve indicated slow subsequent decline in effect.

There was suggestive, but not statistically significant, evidence for two program characteristics that promoted greater effects on achievement outcomes: instructors' education and quality scores. Programs that hired teachers who had at least a bachelor's degree showed greater effects on student standardized achievement, as did programs with higher program quality scores on the Early Childhood Environmental Rating Scale – a scale that includes many evidence-based elements. Data were insufficient to determine the most effective class size, hours, duration, program foci, or the possible benefit of additional components (e.g., health care, parental involvement, or meals).

Overall Assessment

- There is strong evidence that center-based early childhood educational programs improve educational outcomes.
- Program effects on standardized achievement tests decline over time, but persist.
- There is sufficient evidence that center-based early childhood educational programs improve social and health outcomes.
- All three reviewed program types are effective (state and district programs, Head Start programs, and model programs) in improving diverse educational, social-, and health-related outcomes.

Applicability and Generalizability Issues

All studies were conducted in predominantly low-income or racial and ethnic minority communities. Based on the available evidence, programs directed toward these communities are expected to advance health equity.

While the WSIPP analysis did not include studies of children from higher income or predominantly white communities, programs in these communities are generally of higher quality (Duncan and Magnusson, 2013), and it is expected they would also improve educational, social, and health outcomes among children in these communities.

Data Quality Issues

All included studies used high quality designs and confounding was well controlled. Studies often lacked detailed program descriptions, however, making it difficult to assess the effects of program components.

Other Benefits and Harms

The following are drawn from studies included in the evidence review, the broader literature, and expert opinion.

Possible added benefits:

- Development of learning skills (evidence available)
- Lower child care costs for parents
- Additional work-time for parents, and subsequent increased family income (implied)

Potential harms:

- Loss of free, recreational time for children (postulated)
- Loss of family time (implied)
- Development of emotional and behavioral problems (evidence not clear)

Economic Evidence

Economic evidence indicates there is a positive return on investment in early childhood education. The benefits from students' future earnings gains alone exceed program costs. All monetary values reported are in 2014 U.S. dollars.

The economic review included 7 cost-benefit studies conducted in the U.S. (search period through May 2015). Studies evaluated state and district programs (2 studies), the federal Head Start program (1 study), state and district programs and federal Head Start programs (1 study), and model programs (3 studies). Authors of the study on state and district programs and federal Head Start programs conducted an additional analysis to provide national level benefit-cost estimates for these two types of early childhood programs.

Intervention Cost. Estimates were based on funding per participant. National-level estimates for intervention costs were based on data from 40 states that had both state and district programs and federal Head Start programs.

Intervention Benefits. Included studies used the following major components to measure short and long-term benefits:

- Increases in maternal employment and income
- Reductions in crime, welfare dependency, and child abuse and neglect
- Savings in remedial education and child care costs
- Improvement in health outcomes associated with education
- Earnings gains associated with high school graduation

Benefit to Cost Ratio. The major benefit driver for early childhood education programs was students' future earnings gains, which were reported in all of the cost-benefit analyses. The median benefit-to-cost ratio from eleven estimates of earnings gains was 3.39:1 (IQI: 2.48 to 4.39). Additional components of intervention benefits considered the perspectives of parents, taxpayers, and society (including beneficial "spillover" effects associated with increases in education). The overall median benefit-to-cost ratio from seven estimates reported in four studies and the national-level analysis 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.

The three model programs (Perry Preschool, Carolina Abecedarian, and Chicago Child-Parent Center) reported costs and economic outcomes with the longest follow-up time. In general, the benefit-to-cost ratios were highest for these model programs, though all three types of early childhood education programs yielded positive returns on investment. The variation may be explained by differences in population characteristics and the number of included benefit components.

Considerations for Implementation

In the implementation of center-based early childhood education programs, the following issues should be considered.

- Programs are more likely to succeed if they are well-staffed and implemented as intended.
- Though the effect was not significant, programs that hired teachers who had at least a bachelor's degree showed greater effects on standardized achievement tests. In 2011, Head Start programs began requiring applicants have at least an associate's degree in early childhood education.
- Programs with higher quality scores on the Early Childhood Environmental Rating Scale showed greater effects on educational outcomes. These scores are based, in part, on staff training, teacher-student ratios, periodic program evaluation, health screening, and the provision of meals.
- Research from the broader literature indicates that inadequate staff training and turnover make it difficult to maintain program quality and consistency.
- To be effective, evidence-based programs need to be implemented as designed, which means having enough funding and staff who are properly trained to work with the children.

Evidence Gaps

More research is needed to answer the following questions.

- How old should children be when they enroll in an ECE program?
- What should the teacher to student ratio be to assure program benefits?

- What is the minimum program length (in months or years) required to achieve beneficial and long-lasting effects? How many days a week should programs be offered, and for how many hours each day?
- What are the core components that should be included in program curricula, and how can they best be adapted for different groups and settings?
- What are the independent effects of additional program components, such as recreation, meals, health care, parental supports, and social services?
- Why does program effect diminish over time? Are there school, family, or environmental conditions that could be developed to improve the maintenance of early benefits?
- What are the costs and benefits of providing students with meals and health care, engaging parents, and offering other services with programs?
- What are the monetized benefits of self-regulation and emotional development resulting from early childhood education?
- If longitudinal studies of state and local ECE programs were conducted, would they find long term benefits similar to those that have been demonstrated through economic modeling?

The data presented here are preliminary and are subject to change as the systematic review goes through the scientific peer review process.

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Disclaimer

The findings and conclusions on this page are those of the Community Preventive Services Task Force and do not necessarily represent those of CDC. Task Force evidence-based recommendations are not mandates for compliance or spending. Instead, they provide information and options for decision makers and stakeholders to consider when determining which programs, services, and policies best meet the needs, preferences, available resources, and constraints of their constituents.

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