
The Effectiveness of Early Childhood Development Programs

A Systematic Review

Laurie M. Anderson, PhD, MPH, Carolynne Shinn, MS, Mindy T. Fullilove, MD, Susan C. Scrimshaw, PhD, Jonathan E. Fielding, MD, MPH, MBA, Jacques Normand, PhD, Vilma G. Carande-Kulis, PhD, MS, and the Task Force on Community Preventive Services

Overview: Early childhood development is influenced by characteristics of the child, the family, and the broader social environment. Physical health, cognition, language, and social and emotional development underpin school readiness. Publicly funded, center-based, comprehensive early childhood development programs are a community resource that promotes the well-being of young children. Programs such as Head Start are designed to close the gap in readiness to learn between poor children and their more economically advantaged peers. Systematic reviews of the scientific literature demonstrate effectiveness of these programs in preventing developmental delay, as assessed by reductions in retention in grade and placement in special education. (*Am J Prev Med* 2003;24(3S): 32–46) © 2003 American Journal of Preventive Medicine

Introduction

Child development is an important determinant of health over the life course.¹ The early years of life are a period of considerable opportunity for growth and vulnerability to harm. Children's developmental trajectories are shaped by sources of resilience as well as vulnerability. The cumulative experience of buffers or burdens is a more powerful determinant of children's developmental well-being than single risk or protective factors.² Early developmental opportunities establish a critical foundation for children's academic success, health, and general well-being.³

Critical dimensions of child development are self-regulation, the establishment of early relationships, knowledge acquisition, and the development of specific skills. These dimensions are affected by individual neurobiology, relationships with caregivers, and physi-

cal and psychosocial exposures in the caregiving environment.⁴ The interaction of biology and the social environment exerts a powerful influence on a child's readiness to learn and on success in school, both antecedents to health outcomes in later life.^{5,6}

In addition to frequently cited risk factors for developmental dysfunction (e.g., premature birth, low birth weight, sequelae of childhood infections, and lead poisoning), exposure to an economically impoverished environment is recognized as a social risk factor.^{7–9} The socioeconomic gradient in early life is mirrored in cognitive and behavioral development.¹⁰

In the United States, where the rate of child poverty is substantially higher than that of most other major Western industrialized nations,¹¹ children are almost twice as likely as any other age group to live in poverty. Among children under age 18, 16% (more than 11 million children) live in families with incomes below the federal poverty threshold (\$13,861 for a family of three in 2000).¹¹ Early childhood intervention programs seek to prevent or minimize the physical, cognitive, and emotional limitations of children disadvantaged by poverty.¹²

Comprehensive early childhood development programs are designed to improve the cognitive and social-emotional functioning of preschool children, which, in turn, influences readiness to learn in the school setting. Low family income and community poverty lead to racial and ethnic achievement gaps. A recent U.S. Department of Education study shows, for example, that 71% of white children entering kindergarten could recognize letters, compared with 57% of

From the Division of Prevention Research and Analytic Methods, Epidemiology Program Office, Centers for Disease Control and Prevention (Anderson, Shinn, Carande-Kulis), Atlanta, Georgia; the Task Force on Community Preventive Services and Columbia University (Fullilove), New York, New York; the Task Force on Community Preventive Services and University of Illinois, Chicago, School of Public Health (Scrimshaw), Chicago, Illinois; the Task Force on Community Preventive Services, Los Angeles Department of Health Services, and School of Public Health, University of California, Los Angeles (Fielding), Los Angeles, California; National Institute on Drug Abuse, National Institutes of Health (Normand), Bethesda, Maryland

Address correspondence and reprint requests to: Laurie M. Anderson, PhD, MPH, Community Guide Branch, Centers for Disease Control and Prevention, 4770 Buford Highway, MS-K73, Atlanta GA 30341. E-mail: LAA1@cdc.gov.

The names and affiliations of the Task Force members are listed at the front of this supplement, and at www.thecommunityguide.org.

African-American children.¹³ School readiness, particularly among poor children, may help prevent the cascade of consequences of early academic failure and school behavioral problems: dropping out of high school, delinquency, unemployment, and psychological and physical morbidity in young adulthood.¹⁴ There is a strong relationship between measures of educational attainment and a wide range of adult disease outcomes.¹⁵

Head Start, the national preschool education program designed to prepare children from disadvantaged backgrounds for entrance into formal education in primary grades, tries to bridge the achievement gap.¹⁶ The program is based on a comprehensive view of the child that includes cognitive, social, emotional, and physical development, as well as the ability of the family to provide a supportive home environment. The ultimate goal of Head Start is “To bring about a greater degree of social competence in pre-school children from low-income families.”¹⁷

This approach is reflected in Head Start’s program objectives¹⁷:

1. Enhance children’s growth and development.
2. Strengthen families as the primary nurturers of their children.
3. Provide children with educational, health, and nutritional services.
4. Link children and families to needed community services.
5. Ensure well-managed programs that involve parents in decision making.

Created in 1965, Head Start has served more than 20 million children in its first 35 years. In 2001 the federal budget for Head Start was \$6 billion,¹⁸ and state investments in early childhood initiatives grew to \$2.1 billion for programs for preschoolers.¹⁹ The potential impact of early childhood development programs is substantial: in 1997, 62% of the more than 10 million working mothers in the United States had children under age 6, and 13 million children attended early care and education programs each day.¹⁷

The results of this review can help to improve public health policies for young children. Children’s readiness for school encompasses a range of skills that children need to thrive.²⁰ Supports are most critical for children who are at high developmental risk due to poverty.

The Guide to Community Preventive Services

The systematic reviews in this report represent the work of the independent, nonfederal Task Force on Community Preventive Services (the Task Force). The Task Force is developing the *Guide to Community Preventive Services* (the *Community Guide*) with the support of the U.S. Department of Health and Human Services (DHHS) in collaboration with public and private partners. The Centers for Disease Control and Prevention

(CDC) provides core staff support to the Task Force for development of the *Community Guide*. A special supplement to the *American Journal of Preventive Medicine*, “Introducing the Guide to Community Preventive Services: Methods, First Recommendations and Expert Commentary,” published in January 2000²¹ presents the background and the methods used in developing the *Community Guide*.

Healthy People 2010 Goals and Objectives

*Healthy People 2010*²² draws attention to the intersection of health outcomes, cognitive outcomes, and social outcomes and to the educational and income inequalities that underlie many health disparities. Early childhood development opportunities are an intermediate determinant of individual and community health outcomes. Communities, states, and national organizations are urged to “take a multidisciplinary approach to achieving health equity—an approach that involves improving health, education, housing, labor, justice, transportation, agriculture, and the environment, as well as data collection itself.”²²

Information from Other Advisory Groups

The first goal of the National Education Goals panel (created in 1994 by the Goals 2000: Educate America Act) is “By the year 2000, all children in America will start school ready to learn.”²³ Selected goals and objectives from *Healthy People 2010*²² and the National Education Goals related to early childhood development²³ are presented in Table 1. The panel established a national priority for research in education: improve learning and development in early childhood so that all children can enter kindergarten prepared to learn and succeed in elementary and secondary school.

The Institute of Medicine issued corresponding recommendations in 2000.²⁴ The Committee on Capitalizing on Social Science and Behavioral Research to Improve the Public’s Health convened to identify promising areas of social science and behavioral research for improving the public’s health. Two of their nine recommendations apply to early childhood education interventions:

- Recommendation 2: Rather than focusing on a single or limited number of health determinants, interventions on social and behavioral factors should link multiple levels of influence (i.e., individual, interpersonal, institutional, community, and policy levels).
- Recommendation 6: High quality, center-based early education programs should be more widely implemented. Future interventions directed at infants and young children should focus on strengthening other processes affecting child outcomes such as the home environment, school and neighborhood influences, and physical health and growth.

Table 1. Selected National Education Goals and objectives²³ and *Healthy People 2010* goals and objectives²² related to early childhood development

National Education Goals and Objectives

Goal 1: By the year 2000, all children will start school ready to learn

Objectives:

- Children will receive the nutrition, physical activity experiences, and health care needed to arrive at school with healthy minds and bodies and to maintain the mental alertness necessary to be prepared to learn, and the number of low birth weight babies will be significantly reduced through enhanced prenatal health systems
- All children will have access to high-quality and developmentally appropriate preschool programs that help prepare children for school

Goal 2: By the year 2000, the high school graduation rate will increase to at least 90%

Healthy People 2010 Goals and Objectives

Maternal and Child Health Goal: Improve the health and well-being of women, infants, children, and families

Prenatal Care Objective:

Increase the proportion of pregnant women who receive early and adequate prenatal care (Objective 16-6)

Risk Factor Objectives:

Reduce low birth weight (LBW) and very low birth weight (VLBW) (Objective 16-10)

Reduce the occurrence of developmental disabilities (Objective 16-14)

Education and Community-Based Programs Goal: Increase the quality, availability and effectiveness of educational and community-based programs designed to prevent disease and improve health and quality of life

School Setting Objective: Increase high school completion; target: 90% (Objective 7-1)

Conceptual Approach

The general methods for conducting systematic reviews for the *Community Guide* have been described in detail elsewhere.²⁵ Methods specific to social environment and health reviews are described in this supplement.²⁶ The analytic framework used for the early childhood development program reviews, shown in Figure 1, is derived from the social environment and health logic model (also in this supplement²⁶). In the logic model, “opportunities for education and for developing capacity” serve as intermediate indicators along a pathway linking resources in the social environment to health outcomes.

The systematic review development team (the first six authors of this article) postulated that early childhood development programs work by directly improving preschool participants’ cognitive and intellectual performance in early childhood. This early gain increases participants’ motivation and performance in subsequent years, ultimately leading to higher educational attainment and a reduced drop-out rate. In addition, the team postulated that early childhood programs improve children’s social competence and social interaction skills, which, combined with higher educational attainment, helps to decrease social and health risk behaviors. As education increases so does income: both factors are associated with improved health status and a reduction in mortality and many morbidities.

The health component of early childhood programs leads to preventive screening services, improvements in medical care, or both, which subsequently can improve health status and indirectly improve educational attainment (i.e., by identifying conditions that could impede learning through vision screening, hearing screening, or other means). The family component promotes both a supportive home environment for healthy development—which may be enhanced by participation in health and educational opportunities—and job training and employment opportunities for mothers in the child development centers, ultimately supporting the child in all domains.

Selection of Interventions

For this review, we defined early childhood development programs as publicly funded comprehensive preschool programs designed to increase social competence in children, aged 3 to 5 years, at risk because of family poverty. Programs reviewed included Head Start as well as other early childhood programs serving disadvantaged families. Programs are “center-based” (i.e., in a public school or child development center), providing an alternative physical and social environment to the home. A few programs also included a home visitation component. Programs operated full or half days, 9 to 12 months a year.

The systematic review development team assessed early childhood development programs in terms of four different categories of outcomes: cognitive, social, health, and family. Each outcome was evaluated by specific measures.

- Cognitive outcomes: academic achievement test scores, school readiness test scores, IQ test scores, grade retention, and placement in special education;
- Social outcomes: assessment of child’s social competence (behavioral assessments of social interaction) and assessment of social risk behaviors (teen pregnancy, teen fatherhood, high school drop-out, unemployed, use of social services, delinquency, arrests, and incarceration);
- Child health screening: receipt of health screening tests and dental examination within past year; and
- Family outcomes: mother achieving high school graduation, father achieving high school graduation, family income above poverty level, mother employed, father employed, not receiving public assistance, and health screening for siblings of Head Start students.

Table 2. Effectiveness of early childhood development programs on various outcomes: summary effects from the body of evidence

Outcome	No. of outcome measures	Percentage point change (range) ^a	Standard effect size ^b
Cognitive outcomes			
Academic achievement test scores	29 ^{27,28,31-41}		+0.35
School readiness test scores	4 ^{27,30,38,42}		+0.38
IQ test scores	16 ^{31,32,35,36,39,40,42,43}		+0.43
Grade retention	7 ^{28,31-33,36,39,41}	-13% (-25% to -2%)	
Placement in special education	8 ^{27-29,31,32,36}	-14% (-23% to -6%)	
Social outcomes			
Assessment of child's social competence			
Behavior assessments of social interaction	3 ^{38,45,46}		+0.38
Assessment of social risk behaviors	7 ^{29,40,41}		
Delinquency scale			+0.60
Teen pregnancy		-49%	
Teen arrests		-20%	
High school graduation		+17%	
Employed		+27%	
Welfare use		-14%	
Home ownership		+23%	
Child health screening outcomes			
Receipt of health screening tests	1 ⁴⁷	+44%	
Dental exam within past year	1 ⁴⁷	+61%	
Family outcomes			
Mother achieving high school graduation	1 ⁴⁸	+4%	
Father achieving high school graduation	1 ⁴⁸	+3%	
Family income above poverty	1 ⁴⁸	+7.4%	
Mother employed	1 ⁴⁸	+21.6%	
Father employed	1 ⁴⁸	+5.8%	
Not receiving public assistance	1 ⁴⁸	+16%	
Health screening for siblings of Head Start students	1 ⁴⁷	+11%	

^aWhere percentage point change was reported, the effect size calculated is the difference between the intervention and the control group.

^bIn studies where means were reported, the effect size calculated is the difference in means between the intervention and the control group, divided by the standard deviation of the control group.

We searched in five computerized databases: PsychINFO, Educational Resource Information Center (ERIC), Medline, Social Science Search, and the Head Start Bureau research database. Published annotated bibliographies on Head Start and other early childhood development research, reference lists of reviewed articles, meta-analyses, and Internet resources were also examined, as were referrals from specialists in the field. To be included in the reviews of effectiveness, studies had to

- document an evaluation of an early childhood development program within the United States,
- be published in English between 1965 and 2000,
- compare outcomes among groups of people exposed to the intervention with outcomes among groups of people not exposed or less exposed to the intervention (whether the comparison was concurrent between groups or before-and-after within groups), and
- measure outcomes defined by the analytic framework for the intervention.

The literature search yielded a list of 2100 articles. These titles and abstracts were screened to see that the article reported on an intervention study (as opposed

to program process measures, description of curricula, and so on). On the basis of this screening, 350 articles were obtained and assessed for inclusion. Of these articles, most were excluded because they were descriptive reports and not intervention studies. Fifty-seven articles that met the inclusion criteria listed above were evaluated. Of these articles, 41 were subsequently excluded because of threats to validity, duplication of information provided in an already-included study, lack of a comparison group, or lack of an examination of outcomes specified in the analytic framework. The remaining 16 studies (in 23 reports) were considered qualifying studies (see Evaluating and Summarizing the Studies in the accompanying article²⁶), and the findings in this review, summarized in Table 2, are based on those studies.

Reviews of Evidence Effectiveness

Cognitive outcomes. We identified 12 studies²⁷⁻⁴³ (reported in 17 papers) examining cognitive outcomes, including academic achievement, school readiness

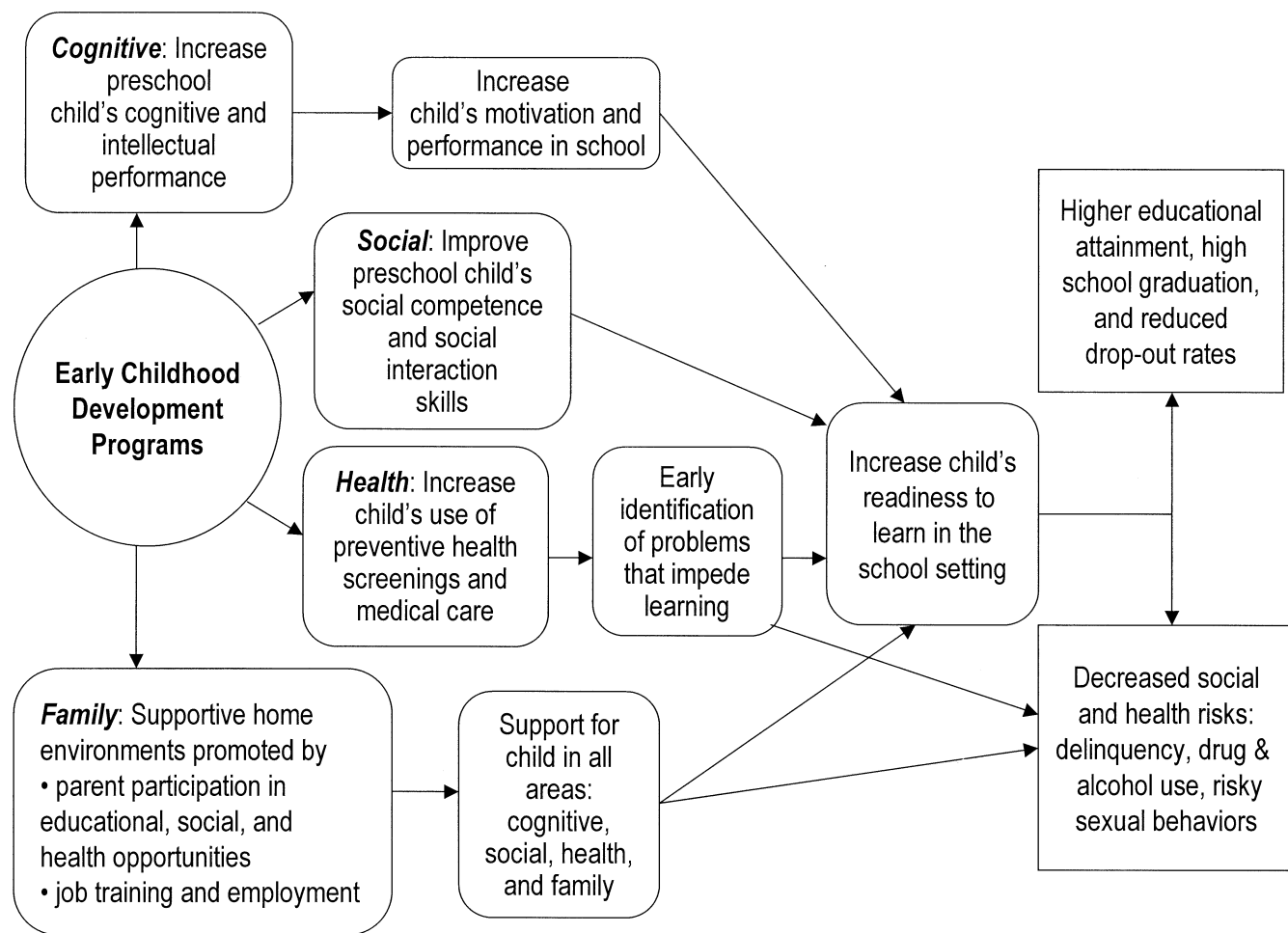


Figure 1. Analytic framework used to evaluate the effectiveness of programs for improving children’s readiness to learn and preventing developmental delay.

tests, IQ, grade retention, and special education placement. Measures and effect sizes are provided in Appendix A. We used the standard effect size as a common metric to compare test scores reported from the variety of cognitive instruments.⁴⁴ (This effect size is calculated as the difference in means [of the reported test scores] between the intervention and the control group, divided by the standard deviation of the control group. This measure can be understood as standard deviation units when comparing mean scores between the intervention and control groups. When percentage point change was reported for cognitive outcomes [e.g., retention in grade and placement in special education], the effect size calculated is simply the difference in change between the intervention and the control group.)

Nine studies^{27,28,31–41} (reported in 13 papers) measured academic achievement through use of standardized academic achievement assessments, such as the Woodcock Johnson or California Achievement Test. Six of these studies^{27,31,32,34–41} demonstrated increases in academic achievement for students enrolled in early

childhood development programs, one study²⁸ reported a negative effect, and two studies^{27,33} provided no data to calculate effect sizes. The median effect size for academic achievement was 0.35.

Three studies^{27,30,38,42} used standardized tests, consisting of cognitive skills assessments relevant to kindergarten curricula, to measure outcomes in terms of school readiness. All three studies demonstrated increases in school readiness for students enrolled in an early childhood development program. The median effect size for school readiness was 0.38.

We identified seven studies^{31,32,35,36,38–40,42,43} (reported in nine papers) that measured cognitive outcomes in terms of intellectual ability (i.e., IQ) through use of standardized tests, including the Stanford-Binet and the Wechsler Intelligence Scale for Children. Six studies^{31,32,35,36,39,40,42,43} demonstrated increases in IQ for students enrolled in an early childhood development program: nine measurements found positive effects on IQ within 1 year after the intervention and seven measurements reported positive effects 3 to 10 years post-intervention. The median effect size for IQ

was 0.43. Although these results are positive, the influence of this gain in IQ on longer-term health and social outcomes is not known.

Student retention rates (i.e., being held back in grade) were measured as cognitive outcomes in five qualifying studies^{28,31–33,36,39,41} (reported in seven papers). Four of these studies^{28,31,32,36,39,41} demonstrated decreases in retention rates for students. Another study³³ reported a positive effect for early childhood development programs on retention rates but provided no data to calculate effect sizes. The median effect size for retention was a 13% difference in retention rates for participants enrolled in early childhood development programs. Retention in grade is highly predictive of failure to graduate from high school, and high school graduation is an important precursor to socioeconomic well-being and improved health status.

Five studies^{27–29,31,32,36} (reported in six papers) measured cognitive outcomes in terms of special education placement. Children placed in special education because of developmental delays, disabilities, or other sources of learning difficulty must meet diagnostic criteria before placement occurs and, according to U.S. Public Law 94-142, must have specialized curricular plans developed to meet specific education, developmental, and counseling needs. All five studies demonstrated reduction in special education placement for students who had been enrolled in early childhood development programs. The median effect size for special education placement was a difference of 14%.

Social outcomes. Five studies^{29,38,40,41,45,46} (reported in six papers) examining social outcomes were included in this review. Three studies^{38,45,46} measured increases in social competence (e.g., reductions in impulsivity and improvements in classroom behavior and intrinsic motivation). At 1 year post-intervention, two studies^{45,46} demonstrated benefits in social competence for students enrolled in an early childhood development program, and one³⁸ showed a negative effect for program participants.

Two studies^{29,40,41} (reported in three papers) examined long-term social outcomes for students enrolled in early childhood development programs. Both studies demonstrated long-term decreases in social risk behaviors. The Perry Preschool program, which followed participants to age 27 and was the intervention examined in these studies, yielded noteworthy results.⁴¹ Compared with nonparticipants, program participants experienced significant improvements in high school graduation, employment status, and home ownership, as well as significant reductions in teen pregnancies, delinquency, arrests, and receipt of social services.

Child health screening outcomes. Only one qualifying study⁴⁷ evaluating child health screening outcomes was identified; other studies that examined these outcomes were noncomparative and, therefore, did not meet

Community Guide study design criteria.²⁵ Hale et al.⁴⁷ found that students in early childhood development programs had increased health screenings and dental examinations compared with those who did not participate in such programs. The study reported a 44% difference in receipt of eight health screening examinations and a 61% difference in receipt of dental examinations among program participants compared with controls. According to *Community Guide* rules of evidence,²⁵ because of limitations in design and execution, this single study alone does not provide sufficient evidence to determine the effectiveness of early childhood development programs on improving child health screening outcomes.

Family outcomes. Two studies^{47,48} examined a family outcome or outcomes. Oyemade et al.⁴⁸ examined the effects of early childhood programs on parental and household outcomes, including educational attainment and employment status, household poverty level, and household receipt of public assistance, and found positive effects for each of these outcomes. Hale et al.⁴⁷ examined the effects of early childhood development programs on health outcomes for siblings of program participants and found an increase in receipt of health screenings among siblings of program participants compared with controls. Because there were only two studies, which looked at different outcomes and had limitations in their design and execution, the evidence was insufficient according to *Community Guide* standards²⁵ to determine the effectiveness of early childhood development programs on improving family outcomes.

Summary of outcomes and effect measures. In the qualifying studies we identified a total of 90 effect measures for the four outcomes (cognitive, social, child health screening, and family) in our analytic framework (as shown in Appendix A). More than 70% of the effects reported were in the cognitive domain, with limited evidence available for social, health screening, and family outcomes. Within the cognitive domain, consistent improvements were found in measures of intellectual ability (IQ), standardized academic achievement tests, standardized tests of school readiness, promotion to the next grade level, and decreased placement in special education classes because of learning problems. The Task Force considered (1) retention in grade and (2) placement in special education as preventable outcomes that result from developmental delay or dysfunction. Less is understood about the relevance of gains in IQ scores to later educational achievement and future success in life.

Applicability

The 16 studies in this review were conducted in various locations in the United States. Nine were conducted in urban settings,^{27,33–35,37,42,43,45,46} three in suburban set-

tings,^{28,29,47} one in a rural setting,³⁹ and three in mixed settings.^{30,36,40} Various target populations were studied: African American in six studies^{29,36,39,40,43,45} and mixed populations, including Latino, Asian, Native American, and others, in three studies.^{30,36,40} Seven studies did not report the ethnicity of the population studied.^{27,28,30,33–35,42} These findings are likely to generalize to similar populations of disadvantaged preschool children.

Other Positive or Negative Effects

Neither the systematic review development team nor the reviewed literature identified harms or other benefits in the body of evidence.

Economic Efficiency

One study conducted in a low-income area in Ypsilanti, Michigan, modeled the costs and benefits of the Perry Preschool program.⁴⁹ The study was conducted in preschool facilities and homes throughout the low-income community. The population consisted of 128 African-American 3-year-olds of low socioeconomic status, from a single school attendance area. The study had a follow-up of 24 years, but lifetime benefits were factored in. The intervention group received 2.5 hours of classroom time with four teachers each weekday and one 1.5-hour home teacher visit. The program lasted 30 weeks. The comparison group did not receive a preschool program. Costs included were teacher and support salaries, school overhead, classroom supplies, and future educational expenses (college). The quantified benefits included lifetime salary differential, avoided welfare costs, and avoided costs of criminal activity. The net benefit of the program in 1997 US\$ was \$108,516 for males and \$110,333 for females. This study was classified as very good according to *Community Guide* quality assessment criteria.⁵⁰ The Perry Preschool program differs from other programs, however, in terms of the degree of support and quality of implementation, and its results, therefore, cannot necessarily be generalized to less intensive programs such as Head Start. Nevertheless, careful consideration of the program is valuable because of the importance of the outcomes, the lasting long-term effects, the consistency of findings across numerous measures, and the strong quality of the research design.

Barriers to Intervention Implementation

The systematic review development team did not identify any barriers to implementation.

Conclusions

A strong body of evidence shows that early childhood development programs have a positive effect on preventing delay of cognitive development and increasing readiness to learn, as assessed by reductions in grade

retention and placement in special education classes. Evidence of improvements in the results of standardized academic achievement and school readiness tests supports this conclusion. At the time of this review, according to *Community Guide* rules of evidence,²⁵ evidence about the effects of early childhood development programs on social cognition and social risk behaviors was limited to the longitudinal results of a single program and, therefore, was insufficient to formulate a recommendation. However, the significant results and strengths of the research on the Perry Preschool program merit continued attention as other longitudinal studies begin to emerge. Evidence was also insufficient to determine the effectiveness of early childhood programs on child health screening outcomes and family outcomes because of a lack of sufficient comparative studies examining these outcomes.

Research Issues

The search for suitable studies evaluating the effectiveness of early childhood development programs on factors other than intellectual functioning revealed significant gaps in research. Although the body of published research is large, relatively few studies assess program impact on subsequent health, well-being, and social success. A 1997 Government Accounting Office report on Head Start found the body of research inadequate for drawing conclusions about its national impact because of a limited focus on short-term cognitive measures.⁵¹ The report also noted important methodologic and design weaknesses, such as non-comparability of comparison groups and lack of the large representative samples necessary to produce results that can be generalized to the national program.

The lack of scientific evidence about social outcomes, child health screening outcomes, and family outcomes is noteworthy, especially because these outcomes relate specifically to program objectives and mandated components in Head Start programs. In terms of social outcomes, a lack of standardized measures and the challenges of implementing longitudinal follow-up may have contributed to the paucity of evidence in this important domain. New research funded by the U.S. Department of Health and Human Services, including the National Head Start Impact Study and the Quality Research Consortium II,^{52,53} holds promise of providing more information on social and emotional development, communication skills, physical well-being, and the family effects of Head Start programs.

It is encouraging that, in addition to the high level of national attention generated by the results of the Perry Preschool program, other promising longitudinal studies with strong research designs examining the impact of early childhood development programs have recently been published and have garnered interdisciplinary interest. (These studies were not included in our

systematic review because they did not compare participation in comprehensive early childhood development programs with nonparticipation.) One such study⁵⁴ looked at the long-term (15-year) effects of the Chicago Child-Parent Center Program, compared with other early childhood intervention programs, on educational achievement and juvenile arrest among low-income African-American children in Chicago. Another longitudinal study⁵⁵ examined the relation of the quality of preschool child care to children's development during their preschool years, and subsequently as they moved into a formal elementary education system. The need still exists, though, for additional studies of strong experimental or quasi-experimental research design using appropriate social, health, and family outcome measures to generate sufficient scientific evidence of the effects of early childhood development programs in these domains.

Research also needs to be expanded to closely examine core characteristics of effective and efficient early childhood development programs: teacher-student ratio, curriculum structure, optimum intensity (i.e., hours per day, months per year), qualifications of program staff members, and levels of parental involvement.

Finally, the complex interactions of biology, individual and family characteristics, and the social and physical environments posited by the *Community Guide's* social environment and health logic model²⁶ underscore the need for additional research, consistent with an ecologic perspective.⁵⁶ Although there is strong evidence from early childhood intervention studies that improvements in cognitive function can translate into early school success, understanding the full impact of childhood social environments on later life experiences will require an interdisciplinary, multilevel research approach. The Office of Behavioral and Social Science Research of the National Institutes of Health has called for integrated sociobehavioral and biomedical research,⁵⁷ and an example of this kind of undertaking can be found in a collaborative study authorized by the Children's Health Act of 2000.⁵⁸ This act authorizes the National Institute for Child Health and Development to collaborate with the Centers for Disease Control and Prevention, the National Institute for Environmental Health Science, and the Environmental Protection Agency to conduct a national longitudinal study of environmental influences (including physical, chemical, biological, and psychosocial) on children's health and development. This interdisciplinary research will be critical to generating needed information for policy decisions on funding and coordination of early childhood development programs within the context of interrelated community services. Current levels of federal and state funding for early childhood development programs are not adequate to support accessible, qual-

ity services for the number of at-risk children who could potentially benefit from participation.⁵⁹

Discussion

Extant program evaluations in the field of early childhood education consist primarily of retrospective analyses of nonexperimental data. As a result, the majority of studies included in the early childhood development reviews are classified as "moderate" in quality by *Community Guide* criteria.²⁵ It should be acknowledged that study design preferences can reflect disciplinary differences in social science research methodology. An unfortunate consequence of this is that some valuable information from promising research could not be included in this review because of the absence of comparison groups—a study attribute deemed necessary by the Task Force for attributing effects to an intervention program. A useful example is a study of Head Start by the National Bureau of Economic Research.⁶⁰ This study, a retrospective analysis of nonexperimental data drawn from the Panel Survey of Income Dynamics, reports on positive long-term outcomes of interest, including educational attainment, earnings, and criminal behavior.

A strong body of evidence shows that early childhood development programs have a positive effect on preventing delay of cognitive development and increasing readiness to learn, as assessed by reductions in grade retention and placement in special education classes. Evidence of improvements in standardized tests of academic achievement and school readiness support this conclusion. A finding of insufficient evidence to determine effectiveness in the areas of children's behavioral and social outcomes, children's health screening outcomes, or family outcomes should not be seen as evidence of *ineffectiveness*. Rather, it identifies a need for additional quality research.

Given the complexities of human development, no single intervention is likely to protect a child completely or permanently from the effects of harmful exposures, pre- or post-intervention. Nonetheless, the strong evidence of cognitive benefits of early childhood development programs is encouraging. We expect that center-based, early childhood development interventions will be most useful and effective as part of a coordinated system of supportive services for families, including child care, housing and transportation assistance, nutritional support, employment opportunities, and health care.

Use of the Recommendation

Interventions that improve children's opportunities to learn and develop capacity are particularly important for children in communities disadvantaged by high

rates of poverty, violence, substance abuse, and physical and social disorder.

Communities can assess the quality and availability of early childhood development programs in terms of local needs and resources and can use the Task Force recommendation to advocate for continued or expanded funding of early childhood development programs. Current levels of federal and state funding are not adequate to support accessible quality services for the number of at-risk children who would benefit from participation.⁵⁹ Child health advocates from all disciplines can use this recommendation to develop testimony for those making policy and funding decisions about the effectiveness of these programs. Healthcare providers can use the recommendation to promote participation in an early childhood development program as part of well-child care. Public health agencies can use the Task Force recommendation to inform the community about the importance of early childhood development opportunities and their long-lasting effects on children's well-being and ability to learn.

Summary: Findings of the Task Force

Early childhood development programs are recommended on the basis of strong evidence of their effectiveness in preventing delay of cognitive development and increasing readiness to learn, as shown by reductions in retention in grade and placement in special education. Evidence was insufficient to determine the effects of these programs on social cognition and social risk behaviors, because only the Perry Preschool program results were available.^{29,41} Evidence was also insufficient to determine the effect of early childhood development programs on child health screening outcomes and family outcomes because too few comparative studies examined these outcomes.

We thank the following individuals for their contributions to this review: Evelyn Johnson, Community Guide Research Fellow; Joe St. Charles, Community Guide Research Fellow; Onnalee Henneberry, Research Librarian; Kate W. Harris, Editor; and Peter Briss for technical support.

Our Consultation Team: Regina M. Benjamin, MD, MBA, Bayou La Batre Rural Health Clinic, Bayou La Batre, Alabama; David Chavis, PhD, Association for the Study and Development of Community, Gaithersburg, Maryland; Shelly Cooper-Ashford, Center for Multicultural Health, Seattle, Washington; Leonard J. Duhl, MD, School of Public Health, University of California, Berkeley, California; Ruth Enid-Zambrana, PhD, Department of Women's Studies, University of Maryland, College Park, Maryland; Stephen B. Fawcette, PhD, Work Group on Health Promotion and Community Development, University of Kansas, Lawrence, Kansas; Nicholas Freudenberg, DrPH, Urban Public Health, Hunter College, City University of New York, New York, New York; Douglas Greenwell, PhD, The Atlanta Project, Atlanta, Georgia; Robert A. Hahn, PhD, MPH, Epidemiology Program

Office, CDC, Atlanta, Georgia; Camara P. Jones, MD, PhD, MPH, National Center for Chronic Disease Prevention and Health Promotion, CDC, Atlanta, Georgia; Joan Kraft, PhD, National Center for Chronic Disease Prevention and Health Promotion, CDC, Atlanta, Georgia; Nancy Krieger, PhD, School of Public Health, Harvard University, Cambridge, Massachusetts; Robert S. Lawrence, MD, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, Maryland; David V. McQueen, National Center for Chronic Disease Prevention and Health Promotion, CDC, Atlanta, Georgia; Jesus Ramirez-Valles, PhD, MPH, School of Public Health, University of Illinois, Chicago, Illinois; Robert Sampson, PhD, Social Sciences Division, University of Chicago, Chicago, Illinois; Leonard S. Syme, PhD, School of Public Health, University of California, Berkeley, California; David R. Williams, PhD, Institute for Social Research, University of Michigan, Ann Arbor, Michigan.

Our Abstraction Team: Kim Danforth, MPH, Maya Tholandi, MPH, Garth Kruger, MA, Michelle Weiner, PhD, Jessie Satia, PhD, Kathy O'Connor, MD, MPH.

We would like to acknowledge financial support for these reviews from the Collaborative Center for Child Well-Being and the Robert Wood Johnson Foundation.

References

1. Halfon N, Hochstein M. Life course health development: an integrated framework for developing health, policy, and research. *Milbank Q* 2002; 80:433-79.
2. Committee on Integrating the Science of Early Childhood Development, Board on Children Youth and Families, National Research Council, Institute of Medicine. Early childhood intervention: views from the field: report of a workshop (Shonkoff JP, Phillips DA, and Keilty B, eds.). Washington, DC: National Academy Press, 2000.
3. VanLandeghem K, Curgins D, Abrams M. Reasons and strategies for strengthening childhood development services in the healthcare system. Portland, ME: National Academy for State Health Policy, 2002.
4. Board on Children Youth and Families, Committee on Integrating the Science of Early Childhood Development. From neurons to neighborhoods: the science of early child development (Shonkoff JP, Phillips D, eds.). Washington, DC: National Academy Press, 2000.
5. Hertzman C. The biological embedding of early experience and its effects on health in adulthood. *Ann N Y Acad Sci* 1999;896:85-95.
6. Brooks-Gunn J, Duncan GJ. The effects of poverty on children. *Future Child* 1997;7:55-71.
7. Brooks-Gunn J, Duncan GJ, Britto PR. Are socioeconomic gradients for children similar to those for adults? Achievement and health of children in the United States. In: Keating DP, Hertzman C, eds. Developmental health and the wealth of nations: social, biological, and educational dynamics. New York: Guilford Press, 1999:94-124.
8. Levine MD. Neurodevelopmental dysfunction in the school-aged child. In: Nelson WE, Behrman RE, Kliegman RM, Arvin AM, eds. *Nelson textbook of pediatrics*. Philadelphia, PA: W.B. Saunders, 1996:100-7.
9. Wadsworth M. Early life. In: Marmot M, Wilkinson RG, eds. *Social determinants of health*. Oxford: Oxford University Press, 1999:44-63.
10. Income, socioeconomic status and health. Auerbach JA, Krimgold BK, eds. Washington, DC: National Policy Association, 2001.
11. National Center for Children in Poverty. Low-income children in the United States: a brief demographic profile. 2002 Available at: <http://cpmnet.columbia.edu/dept/nccp/ycpf.html> Accessed: May 23, 2002.
12. Blackman JA. Early intervention: a global perspective. *Infants Young Child* 2002;15:11-9.
13. West J, Denton K, Reaney LM. The kindergarten year. Washington, DC: U.S. Department of Education, 2000.
14. Hertzman C, Wiens M. Child development and long-term outcomes: a population health perspective and summary of successful interventions. *Soc Sci Med* 1996;43:1083-95.
15. Power C, Hertzman C. Health, wellbeing and coping skills. In: Keating DP, Hertzman C, eds. *Developmental health and the wealth of nations: social,*

- biological, and educational dynamics. New York: Guilford Press, 1999;41–54.
16. Currie J. Early childhood education programs. *J Emerg Med* 2002;15:213–38.
 17. U.S. Department of Health and Human Services. The first progress report on Head Start program performance measures. Washington, DC: Government Printing Office, 1999.
 18. U.S. Department of Health and Human Services. Administration for Children and Families. Head Start research and statistics. 2002. Available at: www2.acf.dhhs.gov/programs/hsb/research/02_hsf.htm. Accessed: July 11, 2002.
 19. Knitzer J. Map and track: state initiatives for young children and families. New York: Columbia University, National Center for Children in Poverty, Mailman School of Public Health, 2000.
 20. Keating DP, Hertzman C, eds. Developmental health and the wealth of nations: social, biological, and educational dynamics. New York: Guilford Press, 1999.
 21. Task Force on Community Preventive Services. Introducing the Guide to Community Preventive Services: methods, first recommendations and expert commentary. *Am J Prev Med* 2000;18(suppl 1).
 22. U.S. Department of Health and Human Services. Healthy people 2010. 2nd edition. Washington, DC: U.S. Government Printing Office, 2000.
 23. U.S. Department of Education. National education goals. 1994. Available at: www.ed.gov/legislation/GOALS2000/TheAct/sec102.html. Accessed: July 19, 2002.
 24. Institute of Medicine (U.S.), Committee on Capitalizing on Social Science and Behavioral Research to Improve the Public's Health, Division of Health Promotion and Disease Prevention. Promoting health: intervention strategies from social and behavioral research. Washington, DC: National Academy Press, 2001.
 25. Briss PA, Zaza S, Pappaioanou M, et al. Developing an evidence-based Guide to Community Preventive Services—methods. *Am J Prev Med* 2000;18(suppl 1):35–43.
 26. Anderson LM, Fielding JE, Fullilove M, Scrimshaw SC, Carande-Kulis VG, Task Force on Community Preventive Services. Methods for conducting systematic reviews of the evidence of effectiveness and economic efficiency of interventions to promote healthy social environments. *Am J Prev Med* 2003;24(suppl 3):25–31.
 27. Barnett WS, Frede EC, Mobasher H, Mohr P. The efficacy of public preschool programs and the relationship of program quality to efficacy. *Educ Eval Policy Anal* 1987;10:37–49.
 28. Bee CK. A longitudinal study to determine if Head Start has lasting effects on school achievement. Unpublished doctoral dissertation: University of South Dakota, 1981.
 29. Berrueta-Clement JR, Schweinhart LJ, Barnett WS, Epstein AS, Weikart DP. Changed lives: the effects of the Perry Preschool Program on youths through age 19. Ypsilanti, MI: High/Scope Press, 1984.
 30. Bryant D, Bernier K, Taylor K, Maxwell K. The effects of Smart Start child care on kindergarten entry skills. North Carolina University, 1998. ERIC Document No. ED 423 068.
 31. Campbell FA, Ramey CT. Effects of early intervention on intellectual and academic achievement: a follow-up study of children from low-income families. *Child Dev* 1994;65:684–98.
 32. Campbell FA, Ramey CT. Cognitive and school outcomes for high-risk African-American students at middle adolescence: positive effects of early intervention. *Am Educ Res J* 1995;32:743–72.
 33. Copple CE, Cline MG, Smith AN. Path to the future: long-term effects of Head Start in the Philadelphia school district. Washington, DC: U.S. Department of Health and Human Services; Office of Human Development Services; Administration for Children, Youth and Families; Head Start Bureau, 1987.
 34. Eisenberg L, Conners C. The effect of Head Start on developmental processes. Washington, DC: Department of Health, Education and Welfare; Office of Economic Opportunity, 1966. OEO-510.
 35. Howard JL, Plant WT. Psychometric evaluation of an Operation Head Start program. *J Genet Psychol* 1967;111:281–8.
 36. Lazar I, Darlington R. Lasting effects of early education: a report from the Consortium for Longitudinal Studies. Chicago: University of Chicago Press, Monographs of the Society for Research in Child Development, 1982.
 37. Lee VE, Brooks-Gunn J, Schnur E. Does Head Start work? A 1-year follow-up comparison of disadvantaged children attending Head Start, no preschool, and other preschool programs. *Dev Psychol* 1988;24:210–22.
 38. Lee VE, Brooks-Gunn J, Schnur E, Liaw F. Are Head Start effects sustained? A longitudinal follow-up comparison of disadvantaged children attending Head Start, no preschool, and other preschool programs. *Child Dev* 1990;61:495–507.
 39. Ramey CT, Campbell FA. Poverty, early childhood education and academic competence: the Abecedarian experiment. In: Huston A, ed. Children in poverty: child development and public policy. New York: Cambridge University Press, 1991;190–221.
 40. Schweinhart LJ, Weikart DP, Larner MB. Consequences of three preschool curriculum models through age 15. *Early Child Res Q* 1986;1:15–45.
 41. Schweinhart LJ, Barnes HV, Weikart DP. Significant benefits: the High/Scope Perry Preschool study through age 27. Ypsilanti, MI: High/Scope Press, 1993.
 42. Sontag M, Sella A, Thorndike R. The effect of Head Start training on the cognitive growth of disadvantaged children. *J Educ Res* 1969;62:387–9.
 43. Zigler E, Abelson W, Trickett P, Seitz V. Is an intervention program necessary in order to improve economically disadvantaged children's IQ scores? *Child Dev* 1982;53:340–8.
 44. Cooper H, Hedges LV, eds. The handbook of research synthesis. New York: Russell Sage Foundation, 1994.
 45. Malakoff ME, Underhill JM, Zigler E. Influence of inner-city environment and Head Start experience on effectance motivation. *Am J Orthopsychiatry* 1998;68:630–8.
 46. Sklerov A. The effect of preschool experience on the cognitive style of reflectivity-impulsivity of disadvantaged children. *Graduate Res Educ Related Disciplines* 1974;7:77–91.
 47. Hale BA, Seitz V, Zigler E. Health services and Head Start: a forgotten formula. *J Appl Dev Psychol* 1990;11:447–58.
 48. Oyemade UJ, Washington V, Gullo DF. The relationship between Head Start parental involvement and the economic and social self-sufficiency of Head Start families. *J Negro Educ* 1989;58:5–15.
 49. Barnett WS. Lives in the balance: age-27 benefit-cost analysis of the High/Scope Perry Preschool Program. Ypsilanti, MI: High/Scope Press, 1996.
 50. Carande-Kulis VG, Maciosek MV, Briss PA, et al. Methods for systematic reviews of economic evaluations for the Guide to Community Preventive Services. *Am J Prev Med* 2000;18(suppl 1):75–91.
 51. U.S. General Accounting Office. Head Start: research provides little information on impact of current program. Washington, DC: U.S. General Accounting Office, 1997. GAO/HEHS 97-59.
 52. Building futures: Head Start impact study. Available at: www.acf.hhs.gov/programs/core/ongoing_research/hs/impact_intro.htm. Accessed: December 12, 2002.
 53. Head Start Quality Research Consortium II (2001-2006). Available at: www.acf.hhs.gov/programs/core/ongoing_research/qrc/qrc_2001.html. Accessed: December 12, 2002.
 54. Reynolds AJ, Temple JA, Robertson DL, Mann EA. Long-term effects of an early childhood intervention on educational achievement and juvenile arrest: a 15-year follow-up of low-income children in public schools. *JAMA* 2001;285:2339–46.
 55. Peisner-Feinberg ES, Burchinal MR, Clifford RM, et al. The children of the Cost, Quality and Outcomes Study go to school: executive summary. Chapel Hill, NC: The University of North Carolina, Frank Porter Graham Child Development Center, 1999.
 56. Bronfenbrenner U. The ecology of developmental processes. In: Lerner RM, ed. Handbook of child psychology. Vol. 1. Theoretical models of human development. New York: John Wiley & Sons, 1998.
 57. Anderson NB. Solving the puzzle of socioeconomic status and health: the need for integrated, multilevel, interdisciplinary research. *Ann N Y Acad Sci* 1999;896:302–12.
 58. Children's Health Act of 2000, Public Law No. 106-310. HR 4365. 2001.
 59. Shumacher R, Greenberg M, Lombardi J. State initiatives to promote early learning: next steps in coordinating subsidized child care, Head Start, and state kindergarten. Center for Law and Social Policy, 2001. Policy Brief.
 60. Garces E, Currie J, Thomas D. Longer term effects of Head Start. Cambridge, MA: National Bureau of Economic Research, 2000. Working Paper 8054.

Appendix A. Studies measuring the effect of early childhood development programs on cognitive, social, preventive health services, and family outcomes.

Author(s), Date	Design suitability, Quality	Intervention	Measure used (Sample size)	Measurement time (in years from intervention)	Effect size
Cognitive as measured by academic achievement tests					
Lazar et al., 1982 ¹	Greatest, Good	Various early childhood programs that were center-based, home-based, or combined but all served "at-risk" children	Math & reading achievement tests (range: 185–351, math; 249–447, reading)	Math: 3rd–6th grade; Reading: 3rd–6th grade	Math: .35; .22; .22; .02; Reading: .28; .12; .18; .04
Schweinhart et al., 1993 ²	Greatest, Good	Perry Preschool	California achievement tests (123)	2, 3, 4, 5, 6, 9 years	.33, .34, .37, .33, .14, .68
Ramey et al., 1991 ³	Greatest, Good	Carolina Abecedarian Project (earliest version, through age 8, of Campbell & Ramey 1994 ⁴ & 1995 ⁵)	WJ-R; CAT (96)	1–2 yr	WJ-R: .89, reading; .45, math; CAT: .74, reading; .81, math
Campbell et al. 1994 ⁴	Greatest, Good	Carolina Abecedarian Project (Study has 4 groups: EE, EC, CE, CC) data reported here are for preschool vs. no preschool only (age 12 follow-up)	WJ-R (96)	6–7 yr	.48 reading; .35 math; .41 writing; .61 knowledge
Campbell et al., 1995 ⁵	Greatest, Good	Carolina Abecedarian Project (same intervention as Campbell & Ramey, 1994 ⁴) (age 15 follow-up)	WJ-R (96)	10 yr	.44 reading; .44 math
Schweinhart et al., 1986 ⁶	Greatest, Good	High/Scope Preschool	CAT (54)	2 yr	.14
Eisenberg et al., 1966 ⁷	Greatest, Fair	Head Start	PPVT (781)	1 yr	.52
Howard et al., 1967 ⁸	Greatest, Fair	Head Start	PPVT (66)	1 yr	.48 (no preschool)
Lee et al., 1988 ⁹	Moderate, Good	Head Start	PPVT (969)	1 yr	.26 (no preschool); .40 (other preschool)
Lee et al., 1990 ¹⁰	Moderate, Good	Head Start (follow-up of 1988 study)	Cooperative primary test (969)	2 yr	Insufficient data to compute effect
Copple et al., 1987 ¹¹	Moderate, Fair	Philadelphia Head Start	WRAT; CAT; Metropolitan Achievement test (10,125)	Various, from 1–5 yr	Insufficient data to compute effect size, no significant effects reported
Barnett et al., 1987 ¹²	Moderate, Fair	S. Carolina implementation of High/Scope preschool curriculum	BSAP (389)	1 yr	Insufficient data to compute effect size, positive effects for black students and boys reported

Appendix continued

Author(s), Date	Design suitability, Quality	Intervention	Measure used (Sample size)	Measurement time (in years from intervention)	Effect size
Bee, 1981 ¹³	Moderate, Fair	Head Start	Metropolitan Reading Test (120)	1 yr	-.61 (favored control group)
Hebbeler, 1985 ¹⁴	Moderate, Limited	Head Start	ITBS or CAT (1393)	Various, from 3–9 yr	Insufficient data to compute effect size, positive effects reported

Cognitive as measured by IQ

Lazar et al., 1982 ¹	Greatest, Good	Various ECD programs	WISC	After 1 yr; after 3–4 yr	.43; .14
Ramey et al., 1991 ³	Greatest, Good	Carolina Abecedarian Project (age 8 follow-up)	WPPSI; WISC-R (96)	From 1–3 yr	.5 WPPSI; .46 WISC at age 6.5; .2 WISC-R
Campbell et al., 1994 ⁴	Greatest, Good	Carolina Abecedarian Project (age 12 follow-up)	WISC-R (96)	6–7 yr	.44
Campbell et al., 1995 ⁵	Greatest, Good	Carolina Abecedarian Project (age 15 follow-up)	WISC-R, age 15 (96)	10 yr	.35
Zigler et al., 1982 ¹⁵	Greatest, Good	Head Start	Stanford-Binet (84)	1 yr	.54
Schweinhart et al., 1986 ⁶	Greatest, Good	High/Scope preschool	Stanford-Binet from K–2nd grade; WISC at age 10 (54)	From 1–3 yr	2.2 (1 yr of preschool); 1.4 (2 yr of preschool); .9 (K); .8 1st grade; .36 2nd grade
Howard et al., 1967 ⁸	Greatest, Fair	Head Start	Stanford-Binet; PTI (66)	1 yr	.34 S-B; .43 PTI
Lee et al., 1990 ¹⁰	Moderate, Good	Head Start	Raven's Progressive Matrices (969)	1 yr	-.05 compared with no preschool
Sontag et al., 1969 ¹⁶	Moderate, Fair	6 mo of Head Start	Stanford-Binet (86)	1 yr	.32

Cognitive as measured by school readiness tests

Lee et al., 1990 ¹⁰	Moderate, Good	Head Start	California Preschool competency test (969)	1 yr	.34
Barnett et al., 1987 ¹²	Moderate, Fair	South Carolina preschool	CSAB (389)	1 yr	+6%
Bryant et al., 1998 ¹⁷	Moderate, Fair	Smart Start	Kindergarten Teacher Checklist (311)	1 yr	.34 (Smart Start vs no preschool for children in poverty)
Sontag et al., 1969 ¹⁶	Moderate, Fair	Head Start	CPSI (86)	1 yr	.62
Handler, 1972 ¹⁸	Moderate, Limited	Head Start	CPSI (125)	1 yr	Subtest A: .16; Subtest B: -.14; Subtest C: .02; Subtest D: .14

Appendix continued

Author(s), Date	Design suitability, Quality	Intervention	Measure used (Sample size)	Measurement time (in years from intervention)	Effect size
Cognitive as measured by rate of retention in grade					
Lazar et al., 1982 ¹	Greatest, good	Various early childhood programs. Some center-based, others home-based, or combined; all served "at-risk" children	Retention rates (682)	Up to 5 yr	-5%
Schweinhart et al., 1993 ²	Greatest, Good	Perry Preschool program	High school graduation rates (123)	Up to 15 yr	-2%
Ramey et al., 1991 ³	Greatest, Good	Carolina Abecedarian Project (age 8 follow-up)	Retention (96)	Up to 1 yr	-21%
Campbell et al., 1994 ⁴	Greatest, good	Carolina Abecedarian Project (age 12 follow-up)	Retention rates (96)	Up to 7 yr	-21%
Campbell et al., 1995 ⁵	Greatest, good	Carolina Abecedarian Project (age 15 follow-up)	Retention rates (96)	Up to 10 yr	-23%
Copple et al., 1987 ¹¹	Moderate, Fair	Philadelphia Head Start & Get Set	Retention rates (10125)	Various	No data to compute
Bee, 1981 ¹³	Moderate, fair	Head Start	Retention (120)	Various, 1-2 yr	-25%
Hebbeler, 1985 ¹⁴	Moderate, Limited	Head Start	Retention rates (1393)	Various	No data to compute, and no significant difference reported
Cognitive as measured by placement in special education					
Lazar et al., 1982 ¹	Greatest, Good	Various	Special ed placement (524)	Up to 10 yr	-15%
Berrueta-Clement et al., 1984 ¹⁹	Greatest, Good	Perry Preschool program	Special ed placement (123)	Up to 15 yr	-12%
Campbell et al., 1994 ⁴	Greatest, Good	Carolina Abecedarian Project (age 12 follow-up)	Special ed placement (96)	Up to 7 yr	-36%
Campbell et al., 1995 ⁵	Greatest, Good	Carolina Abecedarian Project (age 15 follow-up)	Special ed placement (96)	Up to 10 yr	-23%
Barnett et al., 1987 ¹²	Moderate, Fair	South Carolina preschool	Special ed placement (389)	Up to 2 yr	-6%
Bee, 1981 ¹³	Moderate, Fair	Head Start	Special ed placement (120)	Up to 2 yr	-20%
Social as measured by behavioral assessment of social interaction					
Malakoff et al., 1998 ²⁰	Greatest, Fair	Head Start	Persistence at challenging task and intrinsic motivation (78)	Immediately following	.38
Lee et al., 1990 ¹⁰	Moderate, Good	Head Start	Schaefer Behavior Inventory (646)	1 yr	-.29

Appendix continued

Author(s), Date	Design suitability, Quality	Intervention	Measure used (Sample size)	Measurement time (in years from intervention)	Effect size
Sklerov, 1974 ²¹	Moderate, Fair	Head Start	Modification of Matching Familiar Figures test to measure latency in response time (32)	Immediately following	1.82

Social as measured by decreases in social risk behaviors

Schweinhart et al., 1986 ⁶	Greatest, Good	High/Scope vs DISTAR	APL High (measure of social competence), and self-report of delinquent acts (54)	Through age 15	.35 (APL); .60 for delinquency scale
Berrueta-Clement et al., 1984 ¹⁹	Greatest, Good	Perry Preschool program	Employment status; teen arrests; teen pregnancies; welfare payment (123)	Through age 19	+27% -20% -49% -14%
Schweinhart et al., 1993 ²	Greatest, Good	Perry Preschool program	High school graduation; female employed; earnings >\$1000/mo; home ownership; use of social services	Through age 27	+17% +25% +30% +23% -21%

Health outcomes as measured by preventive services

Hale et al., 1990 ²²	Greatest, Fair	Head Start	Record review of health screenings; dental exam (78)	+44% +61%	
Hale et al., 1990 ²²	Greatest, Fair	Head Start	Siblings of children in Head Start vs control for health screenings and immunization rates (78)	+11%	
Oyemade et al., 1989 ²³	Least, Good	Head Start	Mother H.S. graduate; father H.S. graduate; income above poverty; mother employed; father employed; receiving welfare (205)	+4% +3% +7.4% +21.6% +5.8% -11%	

ECD, early childhood development; S-B, Stanford-Binet;

References

1. Lazar I, Darlington R. Lasting effects of early education: a report from the Consortium for Longitudinal Studies. Chicago: University of Chicago Press, Monographs of the Society for Research in Child Development, 1982.
2. Schweinhart LJ, Barnes HV, Weikart DP. Significant benefits: the High/Scope Perry Preschool study through age 27. (Monographs of the High/Scope Educational Research Foundation, 10). Ypsilanti, MI: High/Scope Press, 1993.
3. Ramey CT, Campbell FA. Poverty, early childhood education and academic competence: the Abecedarian experiment. In: Huston A, ed. Children in poverty: child development and public policy. New York: Cambridge University Press; 1991:190-221.
4. Campbell FA, Ramey CT. Effects of early intervention on intellectual and academic achievement: A follow-up study of children from low-income families. Child Dev 1994;65:684-98.

Appendix continued

5. Campbell FA, Ramey CT. Cognitive and school outcomes for high-risk African-American students at middle adolescence: positive effects of early intervention. *Am Educ Res J* 1995;32:743–72.
6. Schweinhart LJ, Weikart DP, Lerner MB. Consequences of three preschool curriculum models through age 15. *Early Childhood Res Q* 1986;1:15–45.
7. Eisenberg L, Conners C. The effect of Headstart on developmental processes. Washington, DC: Department of Health, Education and Welfare; Office of Economic Opportunity, 1966. OEO-510.
8. Howard JL, Plant WT. Psychometric evaluation of an Operation Headstart program. *J Genet Psychol* 1967;111:281–8.
9. Lee VE, Brooks-Gunn J, Schnur E. Does Head Start work? A 1-year follow-up comparison of disadvantaged children attending Head Start, no preschool, and other preschool programs. *Dev Psychol* 1988;24:210–22.
10. Lee VE, Brooks-Gunn J, Schnur E, Liaw F. Are Head Start effects sustained? A longitudinal follow-up comparison of disadvantaged children attending Head Start, no preschool, and other preschool programs. *Child Dev* 1990;61:495–507.
11. Copple CE, Cline MG, Smith AN. Path to the future: Long-term effects of Head Start in the Philadelphia school district. Washington, DC: U.S. Department of Health and Human Services; Office of Human Development Services; Administration for Children, Youth and Families; Head Start Bureau, 1987.
12. Barnett WS, Frede EC, Mobasher H, Mohr P. The efficacy of public preschool programs and the relationship of program quality to efficacy. *Educ Eval Policy Anal* 1987;10:37–49.
13. Bee CK. A longitudinal study to determine if Head Start has lasting effects on school achievement. Unpublished doctoral dissertation: University of South Dakota, 1981.
14. Hebbeler K. An old and a new question on the effects of early education for children from low income families. *Educ Eval Policy Anal* 1985;7:207–16.
15. Zigler E, Abelson W, Trickett P, Seitz V. Is an intervention program necessary in order to improve economically disadvantaged children's IQ scores? *Child Dev* 1982;53:340–8.
16. Sontag M, Sella A, Thorndike R. The effect of Head Start training on the cognitive growth of disadvantaged children. *J Educ Res* 1969;62:387–9.
17. Bryant D, Bernier K, Taylor K, Maxwell K. The effects of Smart Start child care on kindergarten entry skills. North Carolina University, 1998. ERIC Document # ED 423 068.
18. Handler E. Organizational factors and educational outcome: a comparison of two types of preschool programs. *Educ Urban Soc* 1972; 4:441–58.
19. Berrueta-Clement JR, Schweinhart LJ, Barnett WS, Epstein AS, Weikart DP. Changed lives: the effects of the Perry Preschool Program on youths through age 19. Ypsilanti, MI: High/Scope Press, 1984.
20. Malakoff ME, Underhill JM, Zigler E. Influence of inner-city environment and Head Start experience on effectance motivation. *Am J Orthopsychiatry* 1998;68:630–8.
21. Sklerov A. The effect of preschool experience on the cognitive style of reflectivity-impulsivity of disadvantaged children. *Graduate Res Educ Related Disciplines* 1974;7:77–91.
22. Hale BA, Seitz V, Zigler E. Health services and Head Start: a forgotten formula. *J Appl Dev Psychol* 1990;11:447–58.
23. Oyemade UJ, Washington V, Gullo DF. The relationship between Head Start parental involvement and the economic and social self-sufficiency of Head Start families. *J Negro Educ* 1989;58:5–15.