



**ISSUE BRIEF SERIES: EXPLORING THE SOCIAL DETERMINANTS OF HEALTH
EARLY CHILDHOOD EXPERIENCES AND HEALTH – MARCH 2011**

This is one in a series of 10 issue briefs on the social determinants of health. The series began as a product of the Robert Wood Johnson Foundation Commission to Build a Healthier America and continues as a part of the Foundation's Vulnerable Populations portfolio.



Early Childhood Experiences: Laying the Foundation for Health Across a Lifetime

1. Introduction

The earliest years of our lives are crucial in many ways, including how they set us on paths leading toward—or away from—good health. Family income, education, and neighborhood resources and other social and economic factors affect health at every stage of life, but the effects on young children are particularly dramatic. While all parents want the best for their children, not all parents have the same resources to help their children grow up healthy. Parents' education and income levels can create—or limit—their opportunities to provide their children with nurturing and stimulating environments and to adopt healthy behaviors for their children to model. These opportunities and obstacles, along with their health impacts, accumulate over time and can be transmitted across generations as children grow up and become parents themselves.

As noted in an earlier Robert Wood Johnson Foundation report,¹ a large body of evidence now ties experiences in early childhood with health throughout life, particularly in adulthood. Strong evidence also demonstrates that it is possible to turn vicious cycles into paths to health, by intervening early. Although effects of early childhood interventions are greatest for children who are at greatest social and economic disadvantage, children in families of all socioeconomic levels experience benefits from early childhood programs that translate into improved development and health.

The earliest years of our lives set us on paths leading toward — or away from — good health.





Figure 1. A cycle of opportunity or obstacles. At every stage of our lives, social advantage—or disadvantage—is linked to health. Social and health advantage or disadvantage accumulates over time, creating favorable opportunities or daunting obstacles to health. Opportunities or obstacles play out across individuals' lifetimes and across generations. Intervening early in life can interrupt a vicious cycle, transforming it into a path to health for all children and leading to a healthy and productive adult workforce. Improving early childhood social circumstances is one of the most effective ways for a society to achieve its health potential.

2. How do social and economic conditions early in life shape children's health and development, thus shaping adult health?

CHILDREN'S SOCIAL AND ECONOMIC CONDITIONS HAVE DIRECT EFFECTS ON HEALTH

The association between socioeconomic factors and child health is evident from birth, as children born to mothers with low income and educational levels are more likely to be premature or of low birth weight; these birth outcomes are strong predictors of infant survival and also of health across the entire life course. In addition, it is widely recognized that factors such as nutrition, housing quality, and household and community safety—all linked with family resources—are strongly linked with child health. Research shows that children's nutrition varies with parents' income and education and can have lasting effects on health throughout life; for example, inadequate nutrition is linked with obesity during childhood, which in turn is a strong predictor of adult obesity and its accompanying risks of chronic disease, disability and shortened life. Similarly, children exposed to lead-based paint, most commonly found in lower-income neighborhoods, are more likely to suffer from lead-poisoning that can lead to irreversible neurologic damage.

SOCIAL AND ECONOMIC CONDITIONS ALSO AFFECT CHILDREN'S DEVELOPMENT

A large body of research also has shown that experiences in early childhood affect children's brain, cognitive and behavioral development. Scientific advances in recent decades have demonstrated how social experiences in the first few years of life shape infants' and toddlers' development, creating physiological as well as behavioral foundations—adverse or favorable—for health throughout life. Studies tracking children's development have documented environmental factors and interactions of parents and other caregivers with children while measuring cognitive, behavioral and physical development and in some cases physical health; some of these studies have followed children into adulthood. The results consistently link children's development

By kindergarten or even earlier, children in both lower-income and middle-class families are at a developmental disadvantage compared with children in the most affluent families.





with social and economic advantages and disadvantages in the home environments of young children. Neighborhood conditions—such as safety, presence of parks and playgrounds, and access to fresh produce—can have a significant impact as well.

Parents' social and economic resources can affect the quality and stability of their relationships with their infants, and parent-infant relationships affect children's emotional development and the cognitive stimulation they receive. Maternal depression, which can inhibit mother-infant bonding, is more prevalent among low-income mothers than among those with higher incomes.² Higher income and/or educational attainment among parents are associated with more stimulation of and response to infants and young children, which are directly linked to brain development.³ The effect of family socioeconomic circumstances on children's language development is evident as early as 18 months; children in families of middle as well as low socioeconomic status are at a disadvantage compared with their better-off counterparts.⁴ Results of the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K), a national sample of children entering kindergarten, showed that family income is associated with children having the academic and social skills necessary for kindergarten. Compared to children in the highest-income families, children in the lowest-income families were least likely to have the needed skills, but children in middle-class families also performed less well, both socially and academically, than those at the top.⁵

The links between social and economic conditions and children's development may be explained in part by educational differences in parents' awareness of early childhood developmental needs. Research also shows, however, that higher income generally means lower levels of chronic stress in the home, as well as greater resources to cope with stressors—both of which enable parents to interact more often and more favorably with their children.

Brain, cognitive and behavioral development early in life are strongly linked to an array of important health outcomes later in life, including cardiovascular disease and stroke, hypertension, diabetes, obesity, smoking, drug use and depression.





CHILDREN’S DEVELOPMENT SHAPES SOCIAL AND ECONOMIC WELL-BEING THROUGHOUT LIFE

The first few years of life are crucial in establishing the path—including the opportunities and obstacles along the way—that a child will follow to social and economic well-being in adulthood. Particularly without intervention, the gaps in academic and cognitive skills that are apparent when children enter school generally do not close. In fact, these gaps can grow even larger as disadvantaged children progress more slowly than children from higher-income and better- educated families. ECLS-K study results showed that children at higher social risk had lower reading and math scores in kindergarten and also experienced smaller gains in both these areas by the end of third grade than children with fewer family risk factors.⁶ Poor academic performance is linked to subsequently dropping out of high school, lower educational attainment, delinquency and unemployment later in life.

CHILDREN’S DEVELOPMENT SHAPES HEALTH THROUGHOUT LIFE

How a child develops shapes his or her health as an adult. A large body of research has consistently shown that brain, cognitive and behavioral development early in life are strongly linked to an array of important health outcomes later in life, including cardiovascular disease and stroke, hypertension, diabetes, obesity, smoking, drug use and depression—conditions that account for a major portion of preventable morbidity and premature mortality in the United States. The links between children’s development and adult health may involve “connecting the dots” through effects on important social outcomes including educational attainment and/or on health-related behaviors, but in some cases they may be more direct. For example, the chronic stress generally associated with families having very limited socioeconomic resources can affect children’s bodies in ways that lead to lifelong cognitive limitations and behavioral problems as well as poor physical and mental health. Physiologic effects of chronic stress in early childhood have been linked with depression, anxiety, diabetes, cardiovascular disease and stroke later in life.⁷

“The general question of whether early childhood programs can make a difference has been asked and answered in the affirmative innumerable times.”

- Institute of Medicine, 2000



3. How strong is the evidence connecting early childhood development programs with health?

There is very strong evidence that social disadvantages experienced in childhood can limit children’s opportunities for health throughout life. At the same time, however, there also is strong evidence that it is possible to intervene in early childhood, breaking the vicious cycle (from social disadvantage to health disadvantage to more social disadvantage). Knowledge accumulated over the past 40 years supports the conclusion





that children who participate in high-quality early childhood development (ECD) programs experience a range of immediate and long-term health benefits. These health benefits are in addition to cognitive gains and better academic achievement measured in the short term and lower rates of delinquency and arrests later in adolescence—which themselves have strong health effects. The impact appears universal but is particularly great for socially disadvantaged children, for whom early child care, education and family support programs can act as buffers, providing stability and stimulation to the children and strengthening parents’ ability to meet children’s developmental needs at home.

THE EVIDENCE LINKING EARLY CHILDHOOD EXPERIENCES WITH HEALTH

Relevant studies can be divided into two major categories: (1) studies of child development and its health consequences, showing that early childhood experiences affect health indirectly by affecting children’s mental, behavioral and physical development; and (2) studies of early child development (ECD) interventions, which provide strong evidence that ECD programs: (a) directly affect health and health care and (b) indirectly affect health by affecting social outcomes with well-established health consequences.

1. **Studies of early childhood experience and its links with health:** Research findings have consistently shown that (a) *social experiences in early childhood are linked to brain, cognitive, and behavioral development*; and (b) *brain, cognitive and behavioral development are in turn strongly linked—often through effects on educational attainment—to an array of important health outcomes*, particularly later in life. Examples of adult health outcomes linked to early child development by connecting the dots between these two bodies of knowledge include cardiovascular disease and stroke, hypertension, diabetes, obesity, smoking, drug use and depression; these conditions account for a major portion of preventable morbidity and premature mortality in the United States.
2. **Studies of ECD programs (see Table 2):**
 - a) Findings from observational and experimental studies provide evidence of *direct links between particular ECD programs and important health and health care outcomes*. The evidence linking ECD programs directly to health outcomes is less extensive than for social outcomes, but it is important to note that the health effects of interventions in early childhood often do not manifest until middle or later adulthood and few evaluations have followed subjects for several decades. Despite this limitation, *health outcomes* directly linked with ECD programs have been documented, including child injuries, child abuse/maltreatment, depressive symptoms, and health-promoting and health-damaging behaviors such as improved eating habits and hygiene and reduced use of marijuana. Many studies have directly linked particular ECD interventions with *optimal use of health services*, including health screenings, childhood immunizations, fewer hospital days and fewer emergency room visits.
 - b) Experimental and observational studies *indirectly link particular ECD interventions with health outcomes by demonstrating their impact on social outcomes that have well-established and important health consequences*. These outcomes include, for example, teen pregnancy, cognitive development, school performance, IQ, placement in special education, and/or educational attainment, employment (of the child’s mother and of the child in adulthood), income, delinquency and criminal behavior/arrests/incarceration.

Table 1 briefly describes several of the most well known and well evaluated early child development programs in the United States; it also notes estimates of the programs’ potential impact in monetary terms. Table 2 summarizes results of studies of these programs, giving an overview of the range of important health and health-related outcomes that have been demonstrated in association with them.⁸ Studies of ECD interventions provide strong evidence that these programs (a) directly affect health and health care and (b) indirectly affect health by affecting multiple social outcomes with well-established health consequences.





4. Successful early childhood development programs often have been multi-faceted. Do we know what specific components work?

A report issued by the Institute of Medicine (IOM) in 2000 concluded that “the general question of whether early childhood programs can make a difference has been asked and answered in the affirmative innumerable times.” The questions in need of investigation are about the most effective and efficient ways of intervening in early childhood, especially, according to the IOM report, among “children and families who face differential opportunities and vulnerabilities.”⁹

There is wide consensus that key elements of ECD programs include early education and stimulation for preschool children along with support and training for parents and caregivers to improve children’s experiences at home and in the community. Some studies have concluded that programs need to be sustained over multiple years to have lasting effects. Highly trained and responsive caregivers, small class sizes with low child-teacher ratios, safe and adequate physical environments and age-appropriate activities focused on enhancing the cognitive and socio-emotional development of the child are often cited as hallmarks of high-quality child development and day care centers.

Some of the well-evaluated ECD programs have provided a range of services to parents and families in addition to education and stimulation for the children. The Perry Preschool and the Chicago Child-Parent Centers programs tried to improve the parent-child relationship and increase parental involvement in the child’s education through parental education and participation. The Nurse-Family Partnership and Parents as Teachers provide parent training and supportive guidance with the goal of increasing parents’ self-efficacy and life skills. Head Start and the Carolina Abecedarian Project have provided health care, nutrition and social services to participants and their parents. In addition to child care and early education, a range of policies and programmatic interventions can support the healthy development of infants and young children. They include work-based income supplements for the working poor, paid maternity and parental leave, workplace policies promoting and supporting breastfeeding, periodic developmental screening and follow-up services, and environmental protection policies.



Major business groups have advocated universal high-quality pre-school as an essential means of achieving a productive — which means both a healthy and educated — future workforce.

5. Investing in early child development to achieve America’s health and economic potential

Several national business organizations—including the Committee for Economic Development (CED), PNC Financial Services Group, and the Business Roundtable—as well as Nobel Prize-winning economist James J. Heckman and economists Arthur Rolnick and Rob Grunewald of the Federal Reserve Bank of Minneapolis have called for universal early childhood development programs as a wise financial investment in the future U.S. workforce.¹⁰

A larger investment in early child development would benefit the overall economy of the United States. Children who participate in ECD programs are more likely to have the necessary skills—such as abstract reasoning, problem solving and communication—to meet the demands of tomorrow’s work force. A cost-benefit analysis of the Perry Preschool program estimated that approximately 80 percent of the monetary benefits of the program are benefits to the general public, with the remaining 20 percent accruing to the individual children and/or the adults they will become.¹¹ Children who participate in ECD programs are more likely to be healthy and have





higher earnings and are less likely to commit crime and receive public assistance. These benefits translate into tremendous savings for society.

Based on current knowledge, it is reasonable to expect large returns—in human and economic terms—on investment in high-quality early child development programs; at the same time, we must realize that this is a long-term investment, with benefits that may not be measurable for years. If we can, however, take the long view, current knowledge tells us that investing in improving children’s development at the beginning of life is probably the most effective strategy for realizing the health potential of all Americans.

Investing in improving children’s development at the beginning of life is probably the most effective strategy for realizing the health potential of all Americans.

ABOUT THE ROBERT WOOD JOHNSON FOUNDATION

The Robert Wood Johnson Foundation focuses on the pressing health and health care issues facing our country. As the nation’s largest philanthropy devoted exclusively to improving the health and health care of all Americans, the Foundation works with a diverse group of organizations and individuals to identify solutions and achieve comprehensive, meaningful and timely change. For more than 35 years, the Foundation has brought experience, commitment, and a rigorous, balanced approach to the problems that affect the health and health care of those it serves. When it comes to helping Americans lead healthier lives and get the care they need, the Foundation expects to make a difference in your lifetime.

ABOUT THE COMMISSION TO BUILD A HEALTHIER AMERICA

The Robert Wood Johnson Foundation Commission to Build a Healthier America was a national, independent, non-partisan group of leaders that released 10 recommendations to dramatically improve the health for all Americans. www.commissiononhealth.org

ABOUT THIS ISSUE BRIEF SERIES

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REFERENCES

1. Braveman P and Egerter S for the Robert Wood Johnson Foundation. *Overcoming Obstacles to Health: Report From the Robert Wood Johnson Foundation to the Commission to Build a Healthier America*. Robert Wood Johnson Foundation, 2008.
2. Institute of Medicine, Committee on Integrating the Science of Early Childhood Development and Board on Children, Youth, and Families. *From Neurons to Neighborhoods: The Science of Early Childhood Development*. Shonkoff JP and Phillips B (eds). Washington, DC: The National Academies Press, 2000.
3. Bradley RH and Corwyn RF. "Socioeconomic Status and Child Development." *Annual Review of Psychology*, 53: 371-399, 2002; Evans GW. "The Environment of Childhood Poverty." *The American Psychologist*, 59(2): 77-92, 2004; Guo G and Harris KM. "The Mechanisms Mediating the Effects of Poverty on Children's Intellectual Development." *Demography*, 37(4): 431-447, 2000; Votruba-Drzal E. "Income Changes and Cognitive Stimulation in Young Children's Home Learning Environments." *Journal of Marriage and Family*, 65(2): 341-355, 2003; Yeung WJ, Linver MR and Brooks-Gunn J. "How Money Matters for Young Children's Development: Parental Investment and Family Processes." *Child Development*, 73(6): 1861-1879, 2002.
4. Center on the Developing Child at Harvard University. "A Science-Based Framework for Early Childhood Policy: Using Evidence to Improve Outcomes in Learning, Behavior, and Health for Vulnerable Children." 2007. [Accessed May 14, 2008] Available at <http://www.developingchild.harvard.edu>.
5. Barnett WS, Brown K and Shore R. "The Universal vs. Targeted Debate: Should the United States Have Preschool for All?" *Preschool Policy Matters*, Issue 6. New Brunswick, NJ: National Institute for Early Education Research, 2004.
6. Rathbun A and West J. *From Kindergarten Through Third Grade: Children's Beginning School Experiences* (NCES 2004-007). US Department of Education, National Center for Education Statistics. Washington, DC: US Government Printing Office, 2004.
7. Center on the Developing Child at Harvard University. "A Science-Based Framework for Early Childhood Policy: Using Evidence to Improve Outcomes in Learning, Behavior, and Health for Vulnerable Children." 2007. [Accessed May 14, 2008] Available at <http://www.developingchild.harvard.edu>.
8. Karoly LA, Kilburn MR and Cannon JS. *Early Childhood Interventions: Proven Results, Future Promise*. MG-341. Santa Monica, CA: The RAND Corporation, 2005.
9. Institute of Medicine, Committee on Integrating the Science of Early Childhood Development and Board on Children, Youth, and Families. *From Neurons to Neighborhoods: The Science of Early Childhood Development*. Shonkoff JP and Phillips B (eds). Washington, DC: The National Academies Press, 2000.
10. Committee for Economic Development. *CED's Early Education Project* [Accessed October 4, 2007]. Available at <http://www.ced.org/projects/prek.shtml>; PNC Financial Services Group. *PNC Grow Up Great* [Accessed October 4, 2007]. Available at <http://www.pncgrowupgreat.com/about.html>; The Business Roundtable and Corporate Voices for Working Families. *Early Childhood Education: A Call to Action from the Business Community. Why America Needs High-Quality Early Childhood Education*, 2003 [Accessed October 4, 2007]. Available at <http://www.businessroundtable.org/pdf/901.pdf>; Rolnick A and Grunewald R. "Early Childhood Development: Economic Development with a High Public Return." *The Region*, December, 2003; Heckman JJ and Masterov DV. *The Productivity Argument for Investing in Young Children*. Early Childhood Research Collaborative Discussion Paper, 2006.
11. Rolnick A and Grunewald R. "Early Childhood Development: Economic Development with a High Public Return." *The Region*, December, 2003.

ADDITIONAL RESOURCES

- Hertzman C. "The Biological Embedding of Early Experience and Its Effects on Health in Adulthood." *Annals of the New York Academy of Science*, 896: 85-95, 1999.
- Early Childhood Research Collaborative, <http://www.earlychildhoodrc.org/>
- National Institute for Early Education Research, <http://nieer.org/>
- National Scientific Council on the Developing Child, <http://www.developingchild.net/>





TABLE 1: WHAT ARE THE COMPONENTS OF PROMISING EARLY CHILDHOOD DEVELOPMENT PROGRAMS? AND WHAT DO WE KNOW ABOUT THEIR ECONOMIC IMPACT?

Program	Description	Dollars saved for every dollar spent on early childhood development*
Nurse-Family Partnership	Intensive home-visiting program providing medical and psychosocial service beginning during pregnancy and continuing 2 years postpartum for first-time mothers who are generally young, unmarried and/or of low socioeconomic status.	Participants were followed to age 15: Overall sample: \$2.88 saved for every \$1 spent <ul style="list-style-type: none"> Higher-risk sample (both unmarried and low income/education): \$5.70 for every \$1 spent Lower-risk sample (unmarried or low income/education but generally not both): \$1.26 for every \$1 spent
Early Head Start	Federally funded community-based program for low-income pregnant women and families with children up to age 3. Provides family and child development services using a range of strategies (variable across sites) such as home visiting, parenting education, child care, health care and family support.	Not available
Carolina Abecedarian Project	Center-based program operating from 1972-1985 for infants at high-risk for developmental delays and school failure. Emphasized language development. Pre-school and elementary school components. Health, nutrition and social services.	Participants were followed to age 21: \$3.23 saved for every \$1 spent
High/Scope Perry Preschool Project	Center-based early childhood education for low-income, African-American pre-schoolers with low IQ scores. Conducted in Ypsilanti, MI from 1962-1967. Participatory learning approach. Daily classroom sessions emphasized learning through active and direct child-initiated experiences. Weekly home visits to strengthen the parent-child relationship and increase parent involvement in the child's education.	Participants were followed to age 27: \$5.15 to \$8.74 saved for every \$1 spent, (depending on how crime costs were calculated) Participants were followed to age 40: \$17.07 saved for every \$1 spent
Chicago Child-Parent Center Program	Federally funded, center-based program providing preschool and K-3 education to children living in high-poverty Chicago school neighborhoods eligible for Title I funding. Emphasizes parent participation and a child-centered, individualized approach to social and cognitive development.	Participants were followed to age 21: \$7.14 saved for every \$1 spent
Head Start	Federally funded, comprehensive community-based early child development program focused on improving school readiness among children ages 3 to 5 years in low-income families. Programs vary across sites.	Not available

Monetary costs and savings (discounted to 2003 dollars) were determined by estimating the costs/savings associated with child care, child health, education, labor force participation, use of welfare programs, crime, smoking, substance abuse and childbearing. Costs and savings may be based on outcomes for the child, parent and/or the child's descendant.

* Due to differences in the outcomes measured and in the follow-up periods, the savings-cost ratios should not be used to compare programs.

Source: Karoly LA, Kilburn MR and Cannon JS. *Early Childhood Interventions: Proven Results, Future Promise*. MG-341. Santa Monica, CA: The RAND Corporation, 2005.





TABLE 2: HOW DO EARLY CHILDHOOD DEVELOPMENT PROGRAMS AFFECT HEALTH? PROGRAM HIGHLIGHTS
Impact on child participants during their childhood, adolescence and adulthood*

Early childhood development programs	Health, health behaviors and health services	Social outcomes that affect health				
		Children's socio-emotional and/or cognitive development	Educational outcomes	Adult employment and earnings	Adult social services use	Crime
Nurse-Family Partnership	↓ Child abuse ↓ Sex partners (teen) ↓ Alcohol consumption (teen) ↓ Emergency room visits (child) ↓ Hospital days (child)	↑ Positive social/emotional behaviors ↑ Achievement test scores				↓ Arrests, convictions and violations of probation (teen)
Early Head Start		↑ Positive social/emotional behaviors ↑ Achievement test scores				
Carolina Abecedarian Project	↓ Depressive symptoms [†] (adult) ↓ Teen pregnancy ↓ Marijuana use (adult)	↑ IQ scores ↑ Achievement test scores	↓ Special education placement (child/teen) ↓ Grade retention (child/teen) ↑ Years of completed schooling (adults) ↑ Ever attended four-year college (adults)	↑ Skilled employment		
High/Scope Perry Preschool Project	↓ Teen pregnancy.	↑ IQ scores ↑ Achievement test scores	↓ Special education placement (child/teen) ↑ High school graduation (adult)	↑ Employment ↑ Earnings ↑ Income	↓ Use of social services	↓ Arrests (teen/adult) ↓ Arrests for violent crimes (adults) ↓ Time in prison/jail (adults)
Chicago Child-Parent Center Program	↓ Child abuse ↓ Depressive symptoms ^{a,†} (adult)	↑ Social competence ↑ Achievement test scores	↓ Special education placement (child/teen) ↓ Grade retention (child/teen) ↑ High school graduation (adult) ↑ Highest grade completed (adult) ↑ Ever attended four-year college (adults)			↓ Delinquency (teen) ↓ Felony arrests (adults) ↓ Incarcerations (adults)
Head Start	↑ Positive health behaviors (child) ↑ Immunizations (child)	↑ IQ scores	↓ Grade retention (child) ↑ High school graduation (white adults) ↑ College attendance (white adults)			↓ Booked or charged with crime (black adults)

*This does not include impact on the children's parents. "Children" includes teenagers.

↑ = The program was associated with an increase in the specified outcome. ↓ = The program was associated with a decrease in the specified outcome.

^a p-value=0.06, all other results were statistically significant at the p≤0.05 level.

[†]From McLaughlin AE, Campbell FA, Pungello EP et al. "Depressive symptoms in young adults: The influences of the early home environment and early educational child care." *Child Development*, 78(3):746-756, 2007

[‡]From Reynolds AJ, Temple JA, Ou S et al. "Effects of a school-based, early childhood intervention on adult health and well-being: A 19-year follow-up of low-income families." *Archives of Pediatrics & Adolescent Medicine*, 161(8):730-739, 2007

Adapted from Tables S.2 and S.3 in Karoly LA, Kilburn MR and Cannon JS. *Early Childhood Interventions: Proven Results, Future Promise*. MG-341. Santa Monica, CA: The RAND Corporation, 2005.

