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## Early Childhood and the Achievement Gap

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### INTRODUCTION

Schools do not create achievement gaps. By the time children enter kindergarten, dramatic socioeconomic and racial school-readiness gaps are deeply entrenched. Data from the Early Childhood Longitudinal Study (ECLS-K), a large, nationally-representative survey, show that at kindergarten entry, the average cognitive scores of children from high socioeconomic backgrounds are approximately three-fifths of a standard deviation higher than those of children from lower socioeconomic backgrounds (Reardon, 2003; Lee & Burkham, 2002; Coley, 2002).<sup>1</sup> Significant differences in cognitive assessment scores are also evident between racial groups, with white students scoring two-thirds of a standard deviation higher than black children on a math assessment, and two-fifths of a standard deviation higher on a test of reading. The Hispanic-white gap is even more pronounced (Fryer & Levitt, 2004; Rumberger & Anguiano, 2004). Study after study confirms this early childhood gap, which seems to surface as early as 18 months and widen throughout early childhood (Shonkoff & Phillips, 2000).

The goal of the No Child Left Behind Act passed in 2001 was to close the achievement gap between low-income and minority students and their peers. Our increasing understanding of the links between early childhood development and life outcomes has provided solid evidence that any effort to meaningfully narrow the achievement gap also must address these early childhood issues (Shonkoff & Phillips, 2000). There are at least two critical and interrelated reasons to also focus attention on the years prior to children's school entry. The first is that children's *ability* when they are young is highly linked with their later life outcomes. That is, children who lag behind early are likely to continue doing so throughout their school experiences. Secondly, what happens to children in the early years of their life has a disproportionately large impact on their life outcomes relative to other experiences. Because children are so influenced by their early childhood environments, and because early abilities are so predictive of later outcomes, devoting resources to early childhood interventions may yield larger returns than investments later in life.

## THE IMPORTANCE OF STARTING EARLY

### The Role of Early Childhood Experiences

Recent advancements in both the neurobiological and social sciences have vastly expanded our understanding of development in the early years of life (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000; Knudson, Heckman, Cameron & Shonkoff, 2006; Shonkoff & Phillips, 2000; Shore, 1997). While genetic make-up plays a dramatic role, environmental factors including physical surroundings, communication, and nurturing all interact with children's genetic endowment, and play critical roles in their cognitive, social, and emotional development. Further, during early childhood, children's brains develop extremely rapidly, making the early years an optimal time to lay the groundwork for positive lifelong development.

An impressive study conducted by Hart and Risley (1995) highlights the importance of early environmental factors. Forty-two children from professional, working-class, and welfare families were followed through monthly home visits starting when each child was roughly eight months old and continuing through age three. At each visit researchers meticulously recorded every word produced by the child and their parents. As might be expected, the rate of children's language development was highly correlated with the number of words spoken by their parents. Parents in professional families had a much larger vocabulary than those in working class or welfare families, and by age three these gaps were reproduced in their children. For instance, in the welfare group, children's recorded vocabulary size was 525, whereas in the professional group, it was more than double that figure, at 1,116. While it is difficult to truly separate the role of language exposure from the role of social class in driving these results, the study does suggest a strong role for environmental factors.

Focusing specifically on the role of a child's economic well-being, Duncan, Yeung, Brooks-Gunn, and Smith (1998) use the Panel Study of Income Dynamics to assess how family income during three intervals (0–5, 6–10, & 11–15) is linked to high school completion. Their results show that income in the early years is a much stronger predictor of both years of schooling and school completion, than income during the two later periods. The authors offer the importance of early childhood and school readiness as an explanation for their results.

### The Link Between Early Abilities and Later Achievement

Studies also demonstrate that children's cognitive and social abilities at school-entry are strongly related to their later school and life outcomes (Chen, Lee, & Stevenson, 1996; Luster & McAdoo, 1996). For instance, Baydar, Brooks-Gunn, and Furstenberg (1993) followed over 200 children born to black, teenage mothers in Baltimore from birth to approximately age 20. The authors attempted to identify observable antecedents to functional illiteracy. They found that early childhood developmental assessments done when these children were between ages four and six were the strongest predictors of illiteracy 15 years later, even controlling for per-person family income, maternal education, and a host of other family characteristics. These early cognitive scores were also strong predictors of high school completion and post-secondary education (Brooks-Gunn, Guo, & Furstenberg, 1993). In their meta-analysis of eight national studies of the black-white achievement gap, Phillips, Crouse, and Ralph (1998) found that the black-white test score gap at the end of high school could be reduced by at least one-half if the gap was eliminated at school entry.

## The Benefits of Intervening Early

One of the most celebrated early childhood interventions is the High/Scope Perry Preschool experiment, which randomly assigned 123 at-risk, low-income black children either to a high-quality, two-year preschool intervention or a control group. Researchers have followed these children from age three through age 40 and have reported dramatic and long-lasting effects (Schweinhart, Montie, Xiang, Barnett, Belfield, & Nores, 2005). For instance, while 65 percent of program participants graduated from high school, only 45 percent of the control group did; for females alone the proportions were 84 and 32 percent, respectively. At age 40 the median annual earnings of program participants were \$20,800, compared with \$15,300 for the control group. Participants were also more likely to be employed, raise their own children, and own a home or a car, and they were far less likely to experience arrests or utilize drugs. Researchers estimated that the Perry preschool program had a return of approximately \$258,888 per child, or \$17.07 per dollar invested. About three-quarters of this return went to the public through savings on crime, education, and welfare, as well as increased taxes. While involvement in a highly-publicized experiment may have influenced the choices and outcomes of program participants, it is unlikely that these large, persistent effects are being driven only by heightened attention. Intensive interventions early in life appear to meaningfully impact the later success of poor children.

A full evaluation of the potential of early investment in child development requires a comparison of the returns of these types of interventions to those achieved through other avenues. Carneiro and Heckman (2003) compare the impact on life outcomes of early childhood interventions to those of school improvement efforts (e.g., class size reduction and teacher salary increases), adolescent interventions (e.g., mentorship and drop-out prevention programs), job training programs, and college tuition breaks. They conclude that the most powerful drivers of adult outcomes are determined by environmental factors during early childhood. Heckman argues that remediation of early childhood deficits is far more expensive than intervention during the first years of life. He concludes that early childhood interventions are “a rare public policy initiative that promotes fairness and social justice and at the same time promotes productivity in the economy and in society at large” (Heckman, 2006).

## EXPLAINING THE ACHIEVEMENT GAP

The relationship between socioeconomic status and child outcomes has been well documented (Duncan, Brooks-Gunn, & Klebanov, 1994; McLoyd, 1998; Brooks-Gunn & Duncan, 1997; Bradley & Corwyn, 2002). Lack of income or low levels of parental education could have direct negative effects on children’s development through, for instance, inability to access necessary resources. At the same time, it is likely that the socioeconomic gap also is driven by risk factors highly correlated with low levels of income and education, such as depression, stress, hunger, divorce or single parenthood, housing instability, unemployment, unsafe neighborhoods, and inadequate child care options.

While a review of the expansive literature demonstrating associations between environmental factors and children’s early development is beyond the scope of this chapter, we note that researchers have found positive relationships between child outcomes and breast-feeding (Anderson, Johnstone & Remley, 1999), exposure to enriched language environments (Huttenlocher, Haight, & Bryk, 1991), access to books and educational resources (Linver, Brooks-Gunn, & Kohen, 2002), and shared book reading (Bus, Ijzendoorn, & Pellegrini 1995; DeBaryshe,

1993). Conversely, divorce (Pagani, Boulerice, Tremblay, & Vitaro, 1997), maternal depression and stress (Cummings & Davies, 1994; Mistry, Vandewater, Huston, & McLoyd, 2002; Petterson & Albers, 2001), and harsh or punitive parenting style (McLoyd, 1998) are among factors that are negatively correlated with child outcomes. Given the interrelatedness of these factors, and the unclear directionality between them, great care must be taken not to confuse strong correlations with causation, and to seriously consider the possibility of omitted variables.

It is also important to note that some environmental factors have more mixed associations with children's well-being depending on the particular outcome or sub-population considered. For instance, while attending center-based care is positively related with children's cognitive outcomes (Currie, 2001; Barnett, 1995), several studies have found negative associations between long hours at centers and children's behavioral outcomes (Belsky, 2002; NICHD ECCRN, 2003). Interestingly, Brooks-Gunn and Markman (2005) note that many of the environmental characteristics that are correlated with children's achievement also vary systematically by ethnicity and race. Black mothers are less likely to read to their toddlers on a daily basis, and both black and Hispanic families tend to have fewer reading materials and educational resources in their homes than do whites. Across all income groups, Hispanic families are far less likely to send their children to center-based care than their black or white counterparts (USDE, 2006).

### EXPLAINING INDIVIDUAL DIFFERENCES

Before turning to interventions, it is useful to examine another heavily researched possibility, namely that both socioeconomic and racial gaps are driven by genetic differences. When researchers explore the impacts of various environmental factors using non-experimental samples of children, their results generally capture some combination of the environmental factors in which they are interested, and the genetic parental contributions. For instance, a study examining the impact of regular exposure to sonatas and symphonies on infants will overstate the importance of the music if the genetic characteristics of parents who choose to play such music are vastly different from those who do not. Similarly, an observed relationship between maternal education and child outcomes might be spurious if maternal education is a proxy for genetic differences between mothers.

This is a difficult matter to parse out. Genetic and environmental factors are often correlated because most children are brought up by their biological parents, who both determine their genetic characteristics and play a primary role in determining their environment. Some of the most powerful insights on the importance of environmental and genetic factors have come therefore from adoption and twin studies. In this section we summarize the literature on the role of genetic and environmental factors in influencing child development, and stress recent discoveries that suggest important interactions between "nature" and "nurture."

Scarr and Weinberg (1978), one of the seminal works in this field, measured the extent to which typical estimates of the importance of environmental factors are biased by the omission of genetic factors. They concluded that for their sample of adolescents, ages 16–22, from working to upper middle-class families, environmental factors were negligible in explaining differences in IQ scores. The authors compared a sample of biological families to families of children adopted in the first few months of life. They reasoned that because adoptive children do not share their adoptive parents' genetic characteristics, any correlations between environmental characteristics and child outcomes represent unbiased environmental effects. They found that income, parental education, and parental IQ were all significantly more correlated between biological children and their parents than between adopted children and their adoptive parents. For instance, for biologi-

cal children the correlation between their IQ and their mother's education level is 0.24, while for adopted children it is only 0.1. Further, the authors also had data on the education levels of the adopted children's biological mothers, and found that that correlation was 0.21—quite similar to what was found for children raised by their biological parents. This provides further support for their argument that genetic factors are far more powerful predictors than the environment.

Next, the authors compare correlations in IQ scores for biological siblings raised together to those of biologically unrelated siblings raised by adoptive parents. The motivation for these comparisons is similar: biological siblings' IQs are likely to be correlated for both environmental and genetic reasons. In contrast, adoptive siblings share only environmental factors and therefore can be used to isolate environmental effects. The correlation in IQ scores are significantly and dramatically higher for biological siblings, 0.35 compared to -0.03. In fact, the authors show that at age 18.5, on average, biologically unrelated siblings hardly resemble each other at all. They conclude that differences in the intellectual abilities of the adolescents in their sample have very little to do with environmental factors, and that studies that do find environmental associates are likely confounding environmental and genetic factors. These results have been replicated repeatedly across various samples and outcome measures, including cognitive and behavioral outcomes, as well as educational attainment (Harris, 1995; Plomin & Petrill, 1997; Plug & Vijverberg, 2003).

How should this body of evidence be interpreted? Does it imply that environmental factors are unimportant for child development? In her presidential address to the Society for Research on Child Development in 1991, Sandra Scarr summarized results from many quantitative genetic studies and concluded that for children living in typical, "good enough" homes, differences in environment or parenting styles are unlikely to make a large difference for outcomes. While she stressed that the difference between having and not having a caring adult in your life is quite meaningful, she argued that within some normal range of parenting, and barring abuse or neglect, environmental factors are unlikely to matter much for child development.

Many researchers have taken serious issue with the notion that child development is so deterministically driven by genetic factors (Baumrind, 1993; Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000; McClearn, 2003; Rutter, 2002). One important criticism is that the studies on which these conclusions are based often assume that nature and nurture affect childhood development independently and aim to isolate each one's contribution ignoring important interaction effects. McClearn (2004) describes the "distorted perception of genetic and environmental factors as antagonistic, competitive factors in a simplistic, either-or causal scheme," and summarizes some compelling non-human examples that highlight how nature and nurture interact. A well-known example involves two lines of rats bred such that one was quite adept at running through a maze while the other continually struggled. By manipulating the environment of the rats in the months prior to their maze run, researchers were able to influence the rats' performance. "Dull" rats placed in an enriched environment showed marked improvement, and the reverse was true for the "brighter" rats that were placed in a deprived environment (Cooper & Zubek, 1958).

Examples involving humans also strengthen the case for an interaction between genetic and environmental factors. Rowe, Jacobsen, and Van den Oord (1999) used the National Longitudinal Study of Adolescent Health to examine whether parental education has a mediating effect on genetic and environmental influence. They consider correlations in IQ scores for over 3,000 sibling pairs, including monozygotic and dizygotic twins, biological siblings, half siblings, and unrelated siblings. As expected, the IQs of identical twins are highly correlated (0.73) while those of unrelated siblings are quite low (0.07). Among the full sibling sample the estimate of IQ heritability is 0.57, while the shared environment effect is estimated at only 0.13. When the authors disaggregate their results by parental education, a more nuanced story emerges. Adolescents in

the low education group had a much lower heritability estimate—0.2 compared with 0.7 for the high education group. In contrast, the shared environment estimate was 0.23 compared to 0.00 in the high education sample. The results demonstrate that environmental factors have differential effects by parental characteristics. McLoyd (1998) points out that because many of the twin and adoption studies focus on non-poor samples, they may understate the important role of environmental factors for poor children.

Finally, Duyme, Dumaret, and Tomkiewicz (1999) considered a sample of low-IQ children who were abused and neglected as infants and were adopted between ages four and six. Adoptive parents were defined as low, medium, or high SES based on the father's occupation. When the children were 13.5 on average, their IQs were reassessed. All children showed growth, but the magnitude of IQ change varied with parents' SES, with the low SES group raising their IQ by 7.7 and the high SES group experiencing an increase of 19.5 IQ points. These differing effects imply that intensive interventions providing highly enriched environments are likely to have significant effects on child outcomes. These examples demonstrate that environments can play a critical role in mediating genetic characteristics.

### EXPLAINING GROUP DIFFERENCES

Until now, our discussion has concentrated on the role of genetic and environmental factors in explaining differences among individuals. What about achievement differences *between groups*—such as those between blacks and whites? Do environmental factors that help explain the socioeconomic gap explain the racial one? If racial gaps are being driven by socioeconomic differences, then policy makers interested in narrowing the gap might pursue approaches focused on economic factors. If, on the other hand, there is something specific to particular ethnic or racial groups that is leading to disparities, other policy approaches might be warranted.

One approach to parsing out these two issues is to measure statistically how much of the racial achievement gap remains after controlling for a host of socioeconomic factors, such as parental education, poverty levels, and family structure (Duncan & Magnuson, 2005). Phillips, Brooks-Gunn, Duncan, Klebanov, and Crane (1998) use this strategy to examine the black-white test score gap in a large sample of five and six year olds. Without taking background characteristics into consideration, the authors find that five- and six-year-old black children's vocabulary scores are more than a full standard deviation lower than those of white children. However, controlling for a rich set of family background characteristics eliminates two-thirds of this gap. In a more recent study using the ECLS data, Fryer and Levitt (2004) report that controlling for a small set of observable background characteristics the entire black-white test score gap essentially disappears for both reading and math assessments. The same set of controls eliminates the majority of the Hispanic-white gap as well. One reading of these findings is that focusing on improving the economic well-being and environmental conditions of minority children could significantly improve their school outcomes. This interpretation implies that the racial gap is actually just a proxy for the socioeconomic gap. Another possibility is that controlling for a host of family characteristics that are strongly correlated with race masks important racial differences that economic changes alone would not address.

It is important to note that recent efforts to replicate Fryer and Levitt's results using a different data set yielded substantively different results. In Murnane, Willet, Bub, and McCartney's (2006) analysis of the National Institute of Health and Human Development Study of Early Child Care and Youth Development, controlling for a very similar set of socioeconomic

controls did not eliminate the black-white test score gap in either math or early literacy skills. The authors attribute the differing results to differences in the types of assessments used in each study.

Critics of the environmental argument posit that perhaps the lower achievement of black and Hispanic children is driven by genetic factors. If this is the case, they argue, excluding a true measure of genetic background in models of the achievement gap would lead to a serious omitted variable bias because genetic characteristics could be related to both low socioeconomic status and children's achievement. Despite these concerns, two comprehensive reviews of the literature have concluded that there is very little evidence to support the notion that significant portions of the achievement gap *between* groups (i.e., the black-white gap) can be explained by genetic factors (Dickens, 2005; Nisbett, 1998). Many of the most compelling arguments against the genetics hypothesis are found in studies that indirectly challenge the "nature" explanation by demonstrating the powerful effects of environmental or "nurture" factors, on child outcomes. For instance, Eyferth (1961) assessed the intelligence scores of children born after World War II to white German women and American soldiers, either black or white. If the genetics hypothesis holds, we would expect those children born to two white parents to outperform their mixed-race counterparts. However, the IQs of the two groups were practically identical (97 and 96.5, respectively), and there were no indications that the results were driven by unusually high or low intelligence scores for the black and white soldiers, respectively (Dickens, 2005).

A recent study uses data from the Early Childhood Longitudinal Study Birth cohort—a nationally representative sample of over 10,000 children between 8 and 12 months—to cast further doubt about genetic explanations for racial differences. Fryer and Levitt (2006) find that only controlling for children's age and gender, the gap between black and white infants on a developmental assessment is only 0.06 of a standard deviation, and is even smaller for Hispanics. This gap is quite small compared to the one observed among older children in other studies, and it is therefore damaging to the genetics argument. The authors conclude that either genetic factors are not the primary drivers of racial achievement gaps or that genetic influences emerge systematically after age one.

Certainly, we have much more to learn about the interplay among genetics, environmental factors, and child development. It is important to emphasize that even if there were genetic differences among racial or ethnic groups, this need not imply that environmental interventions will be ineffectual. Given the strong success of certain early childhood interventions in improving the well-being of poor, minority children, it seems safe to say that altering environmental factors is one critical approach to the narrowing of both socioeconomic and racial gaps.

## THE ROLE OF INTERVENTIONS

Though we do not know the specific mechanism by which socioeconomic status relates to child outcomes, two theoretical models are often posited (Linver, Brooks-Gunn, & Kohen, 2002). The "investment model" focuses on the direct role of income as a means for providing children the resources they need. In contrast, the "family stress model" focuses on the negative impacts of poverty on parents' mental health and parenting ability, which in turn negatively influences children. The two models imply distinct types of parental interventions. The first is associated with programs aimed at improving parents' economic well-being through work incentives, income assistance, education supports, or other routes. The second calls for programs that support parents, teaching them effective parenting techniques and reducing stress.

## Family Resources

Evaluating the impacts of employment and income on child outcomes is challenging because both are likely to be correlated with other relevant parental characteristics. A series of randomized welfare experiments conducted in the 1990s has provided a unique opportunity to examine the relationship between parental employment and child outcomes (Morris, Huston, Duncan, Crosby, & Bos, 2001; Zaslow, Moore, Brooks, Morris, Tout, Redd, & Emig, 2002; Clark-Kauffman, Duncan, & Morris, 2003). Researchers assessed the impact of several employment-based welfare programs targeted at single-parent families and found that overall the programs did not strongly affect child outcomes. However, programs that also included earning supplements yielded systematic positive effects on the cognitive outcomes of children, two to four years after program entry. These studies suggest that parental employment, when combined with increased resources, can positively impact child outcomes. However, it is important to note that adolescents did not benefit. In fact, there was some evidence that program participation was associated with detrimental outcomes such as more frequent smoking and drug use, and more frequent behavior problems in school.

Magnuson and Duncan (2002) argue that whenever interventions are indirect they are less likely to yield meaningful impacts on child outcomes. As an example, many policy makers have designed interventions aimed at increasing maternal education levels in the hopes that the higher education levels would lead to positive impacts for the children. In order for such interventions to yield the desired results two sequential processes must occur. The intervention would have to successfully raise maternal education, and then that maternal education would have to affect child outcomes either through specific skills learned, increased earnings, or another mechanism. Indeed, experimental studies of these types of interventions demonstrate that even when they do raise maternal education, this increase fails to translate into significant benefits for children (Quint, Bos, & Polit, 1997; McGroder et al., 2000).

## Family Processes

A strong association between early literacy practices and child outcomes has led to a variety of parental interventions focused on home reading practices. One strategy involves promoting literacy through children's regularly scheduled doctor's visits. These relatively inexpensive interventions have been associated with improvements in low-income, black and Hispanic parents' literacy behaviors (Golova et al., 1999; High et al., 2000). In addition, program participation appears correlated with children's early language development. The Reach out and Read (ROR) program, for instance, involves reading to children in the waiting room of clinics, giving them developmentally appropriate books to take home, and having pediatricians discuss the benefits of reading during the actual appointment. Mendelsohn et al. (2001) compared the vocabulary development of poor, minority children in two similar inner-city pediatric clinics—one of which had used the ROR for three years, while the other had only recently introduced the intervention. Multivariate regressions showed that those children who had been visiting the clinic that offered ROR had significantly higher scores on measures of both receptive and expressive language. Parental literacy interventions carried out through child care centers and elementary schools also are associated with improved short-term literacy outcomes for children (Whitehurst, Arnold, Epstein, Angell, Smith, & Fischel, 1994; Jordan, Snow, & Porsche, 2000). To our knowledge, there are no experimental studies that demonstrate long-term benefits associated with parent literacy interventions.

Some long-term impacts have been found for more broadly-aimed parenting interventions.

One of the most rigorously studied examples is the Nurse Home Visitation Program, which began in a semi-rural area of New York in 1978 and followed families longitudinally through adolescence (Olds et al., 1997). Five hundred pregnant women were randomly placed in either a treatment or a control group. These women were predominantly white, low-income, and unmarried. Women in the treatment group received regular home visits that focused on maternal health, positive parenting, and personal development. The control group received developmental screenings for their children at 12 and 24 months of age, but no further maternal support services<sup>2</sup>. The 15-year follow-up showed that program participants were less likely to be perpetrators of child abuse and neglect. The subgroup of mothers who were unmarried and low-income at the time of their pregnancy also experienced fewer subsequent births, fewer months on welfare, and fewer arrests.

Further, program participation had meaningful social and health benefits for the children of the unmarried and low-income sub-sample. They displayed lower levels of arrests, lower incidents of running away, fewer sexual partners, and less regular alcohol consumption. No systematic cognitive benefits were reported at age 15. Overall, results from this experiment suggest that parenting interventions *can* have meaningful impacts on certain child outcomes. Further, the experiment indicates that poor children from single-parent homes seem to benefit differentially from this intervention, suggesting that targeted services could be most efficient.

The outcomes of the nurse visitation program aside, findings from most home visitation programs have been decidedly underwhelming. Gomby, Culross, and Behrman (1999) summarized results from six randomized studies of large parental intervention programs. Though interventions differed with respect to target populations and intensity, all aimed to support and promote positive parenting as a strategy for improving child outcomes. While some of the programs resulted in various improvements in parenting practices, they had few measured effects on children's development. The authors considered the few small positive effects identified as unsystematic exceptions. While early attrition and inconsistent participation may partially explain the lack of positive outcomes, the intensity of these home visitation programs is likely the most relevant factor. As Gomby et al. point out, it may be unrealistic to expect programs involving 20–40 hours of direct contact over several years to have such significant impacts on parental behaviors, that children's outcomes are affected in a meaningful and significant fashion. As such, more intensive, directly child-focused interventions might be preferable over parent directed interventions (Magnuson & Duncan, 2002).

## Centers

Center-based programs are among the most highly utilized direct child interventions, with 69 percent of four year olds nationwide participating in 2005 (U.S. Department of Education, 2006). And these interventions have shown consistent positive effects on cognitive development.

**Experimental Evidence.** Some of the most compelling evidence on such interventions comes from a handful of well-designed randomized experiments. The primary advantage of experimental studies is that, when done well, they eliminate doubts about selection bias. Since children are assigned to an intervention or control group by chance, we can be fairly certain that their post-intervention results represent the causal relationship between the intervention and child outcomes. The most famous of these studies is the High Scope/Perry Preschool, which shows significant differences between the treatment and control group at every wave of the study from preschool to age 40. A similar experiment—the Carolina Abecedarian project—randomly assigned 111 infants born to extremely poor, high risk mothers into a treatment and control group

(Ramey & Ramey, 2002). Most of the mothers enrolled in the study were young, black, had less than a high school education, and were single. Both the treatment and the control group received some enriched social services; but starting at age six months, children in the treatment group were enrolled in an intensive, high quality preschool program which ran full-day, full-year through kindergarten entry. While the cognitive performance of the two groups was roughly similar until age nine months, by 18 months a gap rapidly emerged, and a dramatic 14-point difference on an IQ test persisted through the preschool years. In the most recent follow-up, the Abecedarian children are 21, and the treatment group continued to outperform the control group on an IQ test, as well as on a reading and math assessment (Campbell, Ramey, Pungello, Sparling, & Miller-Johnson, 2002). In addition, the treatment group was far more likely to be enrolled in a four-year college (36 percent compared to 14 percent), and far less likely to have been a teen parent (26 percent compared to 45 percent).

Taken together, the Perry and Abecedarian preschool experiments convincingly show that intensive, high quality preschool interventions can have powerful and lasting effects, at least for very poor, black children. That said, both interventions targeted extremely at-risk black populations, making it difficult to generalize their results to the population at large. Further, both of these programs offered high-quality care and in turn were far more expensive and intensive than more "typical" preschool programs. Therefore, these studies cannot necessarily help us estimate the effects of programs that, for instance, last only one year, meet only half day, or do not employ highly educated teachers with engaging curriculums.

*Non-Experimental Evidence.* Results from large-scale, non-experimental studies are the best available source for understanding the relationship between more standard center-based interventions and child outcomes. While determining causality is more difficult in non-experimental analyses, these studies tend to find a positive correlation between center participation and children's cognitive outcomes, though, as might be expected, the magnitude of the effects are smaller than those observed in the more intensive preschool experiments (Barnett, 1995; Currie, 2001).

The Child Parent Centers, which opened in 1967, provide a useful example. These centers offered comprehensive social, health, and educational support services for impoverished children ages three through nine, and their parents. Specifically, the program included a high quality half-day, nine month preschool program, home visitation, outreach services, and comprehensive school-age services (reduced class size, enrichment activities, etc.) for a subsample of participants. Reynolds, Temple, Robertson, and Mann (2002) compared the outcomes of program participants to those of demographically similar children living in the neighborhoods where centers were operating. They found that program participants had higher cognitive and achievement scores through age 15, lower levels of grade retention and special education placements through age 15 and 18, respectively, and higher rates of school completion through age 21.

Several research teams have looked at the effects of center-care participation on child outcomes using the nationally representative ECLS-K (Loeb, Bridges, Bassok, Fuller, & Rumberger, in press; Magnuson, Ruhm, & Waldfogel, 2004; Rumberger & Tran, 2006). All reported a positive relationship between participating in center-based care in the year prior to kindergarten, and children's cognitive outcomes. Controlling for a rich set of environmental variables, Magnuson, Ruhm and Waldfogel (2004) found that center attendees outperformed children who stayed at home on both a reading and math assessment, with effect sizes of 0.13 and 0.09—enough to move the average child from the fiftieth to the fifty-fifth percentile. Consistent with previous studies examining this issue, the ECLS-K data showed that along with the cognitive benefits, participation in center-based care—particularly for extended hours—is associated with some-

what heightened levels of externalizing behavior, which includes fighting, arguing or, disrupting (NICHD, 2003).

One important advantage of the ECLS-K data is that its large sample size allows for meaningful analysis of subgroup differences. Magnuson et al. (2004) found that the relationship between center care and cognitive outcomes is particularly large for very poor children, or for those with low parental education. Loeb et al. (2007) showed important differences in the impact of center participation between racial groups. For example, they found that the gains associated with center attendance (compared to home-based care) are largest for English proficient Hispanics. These results suggest that certain groups are more likely to gain from participation and that targeted interventions might be useful for eliminating gaps.

Researchers are cautious when interpreting these findings because, at least in part, the positive association between center-based care and child outcomes found in non-experimental data is likely driven by a selection mechanism, whereby those children who attend center care have unobserved characteristics that influence both their entrance into this type of care and their eventual outcomes. To get at this, researchers have used a variety of statistical strategies.

Gormley, Gayer, Phillips, and Dawson (2005) used one such strategy to evaluate the effects of Oklahoma's universal preschool program, which established a free, voluntary preschool open to all four year olds in the state. Run through the Oklahoma public schools, the preschool program requires all classrooms to have 20 or fewer children and all teachers to have a bachelor's degree as well as an early childhood credential. Almost three-quarters of the eligible children in Oklahoma participate in publicly funded preschool, which is the highest penetration rate nationwide. To get around selection issues, Gormley et al. used a regression discontinuity design, taking advantage of the program's strict use of birthday cut-off dates for determining program eligibility. The authors compared a treatment group comprised of children who enrolled in one year, and a control group of those children whose birthdays were after the cutoff date but who enrolled in the following year. Adjusting their regressions for age as well as demographic characteristics, the authors found a 0.79 of a standard deviation gap on a letter-word identification measure, and a 0.38 standard deviation gap on an applied problem measure between the treatment and control group. Further, they showed that the positive preschool effects arise in all racial and socioeconomic subgroups, though they were unable to compare the magnitude of the effects across groups. These results are certainly promising, and it will be interesting to see whether the benefits of preschool persist as children progress through school.

A recent analysis of the effects of Head Start, a large-scale, federally funded early childhood intervention, also creatively utilized regression discontinuity. When Head Start was first introduced in 1965, the Office of Economic Opportunity tried to encourage take-up in high poverty counties by providing the 300 poorest districts in the country with intensive technical assistance for funding proposals. This policy created a sharp discontinuity in program funding between those counties on either side of the technical assistance cutoff point. Ludwig and Miller (2007) took advantage of this exogenous discontinuity to assess whether counties that fell just below the cutoff for technical assistance varied systematically on health and educational outcomes from counties that fell just above the cutoff. The authors report significantly lower mortality rates in those counties just below the cutoff line, and they demonstrate these drops in mortality are driven by declines in deaths from "Head Start susceptible causes" such as smallpox, polio, and measles, rather than injuries. They also find slightly weaker evidence of differences in educational attainment. If the authors are correct in their assumption that counties falling on either side of the cutoff were initially quite similar, any differences in child outcomes could be attributed to the Head Start program, without concern over selection issues.

*Quality.* One limitation of much of the data used to study the effects of preschool is the lack of information on the quality of centers that children attended. While results tell us about the average effects of centers, we do not know whether these effects vary based on characteristics of their curriculum, instruction, or facilities. Magnuson et al. (2004) attempt to get at this issue in the ECLS-K data by separately analyzing program effects for children whose parents indicated they attended a “pre-kindergarten” program and those who attended other types of centers (nursery school, day care, preschool, etc). The authors assume that the pre-kindergarten programs are school-based programs that have higher levels of regulations and a more educational curriculum. Indeed, they find that cognitive outcomes are higher in the pre-kindergarten group, though levels of externalizing also appear higher in these settings.

A large body of literature has more directly examined the effects of observable measures of care quality on child outcomes (Loeb, Fuller, Kagan, & Carrol, 2004; NICHD, 2002; Peisner-Feinberg et al., 2001). These studies all indicate that higher quality centers—in terms of both structural and process measures—have a larger and a more long-lasting effect on children’s cognitive and social outcomes. For instance, results from the Cost, Quality & Outcomes Study showed that children who had closer, more nurturing relationships with their care providers displayed stronger cognitive and social skills through second grade. Further, the impact of care variations were largest for high-risk children whose mothers have very low levels of education. This finding strengthens the case for investing most heavily in programs for the neediest children, though, once again, the studies do not unequivocally establish the causal nature of the relationship between center characteristics and children’s outcomes.

*Sustaining Effects.* While the short term effects of preschool programs are encouraging, policy makers and researchers worry about whether or not program effects dissipate as preschool children move through elementary school. Magnuson, Ruhm, and Waldfogel (2004) found that by the spring of first grade, the benefits associated with attending prekindergarten had mostly disappeared. Karoly et al. (1998) synthesized the results from evaluations of nine early childhood interventions, and found similar evidence of diminishing cognitive and academic outcomes in many of the programs considered. Why is it that the effects of programs such as the Perry Preschool, Abecedarian, and the Child Parent Centers last into early adulthood and beyond, while those of more broad-based, naturally occurring interventions seem to fade out after the first few years of school? One explanation is the wide ranging quality of typical preschool interventions. Based on the quality literature presented above, it seems plausible that when aggregating the effects of *all* preschool programs together, the low quality of some programs masks long-lasting effects from other higher quality programs.

Another possible explanation stems from the intensity or dosage of early childhood interventions. Children’s exposure to center-based interventions varies dramatically both in terms of age at entry and in terms of hours per weeks. To the extent that more intensive interventions are stronger predictors of long-term benefits for children, aggregating the outcomes of all center attendees irrespective of the amount of time they have spent in center could mask effects. The Infant Health and Development Program (IHDP) provides an illustrative example. The IHDP began in 1985 and randomly assigned low-birth weight infants and their families to a treatment or a control group. Families in the treatment group received regular home visits through the child’s third birthday, and children had access to high-quality, year-round, center-based care from age one to age three. At age three, the treatment group significantly outperformed the control on cognitive outcomes, but by age eight there were no significant differences. Hill, Brooks-Gunn, and Waldfogel (2003) hypothesized that, in part, the lack of sustained results at age eight might be related to center exposure. To get at selection issues that could influence which children at-

tend centers most intensively, the authors used a variety of matching strategies, and compared children with high center participation (>350 days or >450 days) to children with very similar characteristics who were in the control groups. As they had predicted, regular center attendees did in fact demonstrate sustained cognitive outcomes at age eight. Further, the group who had the highest intervention dosage (>450 days) showed the greatest benefits, bolstering the notion that intervention intensity matters for sustaining results.

Finally, a third explanation for the “fading” effects of child care interventions has to do with the experiences children have once they enter school. Several studies have considered the possibility that school quality plays an important role in sustaining or negating the effects of center-based programs. Lee and Loeb (1995) test this hypothesis within the context of Head Start, the federally-funded comprehensive preschool program that aims to narrow the school-readiness achievement gap for extremely disadvantaged children. Using data from the National Education Longitudinal Study of 1988, a nationally representative sample of approximately 25,000 eighth graders, the authors compare the school quality of children who reportedly attended Head Start, another type of preschool program, or no preschool intervention. Defining school quality broadly—to include social composition, academic excellence, perceived safety, and teacher student relationships—the authors find that eighth-graders who attended Head Start end up in significantly worse schools compared to children who attended other types of preschools, even when they control for race, parental education, and an income-to-needs ratio. They conclude that the poor quality of schools attended by Head Start participants seriously undermines the likelihood of sustained program effects.

Currie and Thomas (2000) expand on this analysis by first noting that the extent of impact fade out is systematically different for blacks and whites, with the effects on blacks disappearing rapidly, but white children experiencing long-lasting benefits through adolescence. They argue that if, indeed, the school quality explanation is driving fade out effects, the difference in school quality for Head Start participants and non-Head Start participants must be larger for blacks than for whites. Their results support this claim, and they suggest that environmental factors in the years after a child completes a center-based intervention can seriously negate the initial impact of the program. In a separate study, Garces, Duncan, and Thomas (2002) report that white Head Start attendees experience significant long term gains from Head Start participation, including higher levels of high school completion and earnings during early adulthood. This evidence suggests that the benefits of early childhood intervention would be maximized if combined with high-quality experiences for participants as they enter elementary schools.

Evidence from the Chicago Child Parent Centers further supports this notion, because those children who extended their participation into the first years of elementary school displayed higher levels of school achievement from elementary school through high school, and also had significantly fewer special education placements (Reynolds, Temple, Robertson, & Mann, 2002).

## CONCLUSIONS

This review has highlighted several crucial points about the early achievement gap. First, systematic differences in development and ability emerge long before children enter school, and those children who start school at a disadvantage are likely to remain behind their peers throughout school and beyond. Second, advances in research have highlighted the importance of the early childhood environment as a contributing factor to this school readiness gap. And third, despite our continuously-expanding understanding of child development, implementing programs that meaningfully narrow the gap is a challenging task. Most interventions directed at parents have

lackluster effects on children, and the effects of center programs are both highly dependent on quality and, at times, fleeting.

Nevertheless, there are several compelling examples of interventions that confirm the positive potential of early childhood interventions. We know that the most successful of these programs are intensive and involve substantial investments. We also know that the biggest program benefits are typically seen in the neediest children. Given the vast impediments that very poor children face, neither of these findings is particularly surprising. The bottom line is that there are no easy solutions. Achieving sizeable practical results necessarily means making a highly targeted, long-term commitment to those children most in need.

## NOTES

1. The SES gap represents the difference in scores for children who are one standard deviation apart on a continuous SES measure which is a composite of parental income, education and occupation.
2. A subgroup of the control group also received care for prenatal and well-child care.

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