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# 18
# Infant Health and Development Program

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# 18
# Infant Health and Development Program

The Infant Health and Development Program (IHDP), carried out in eight medical centers from 1985 to 1988, was designed as a test of providing comprehensive early intervention services to low birth weight (LBW) children. These children were targeted because of their heightened risk of developing learning disabilities, experiencing academic problems, and exhibiting behavior problems. A national IHDP office guided the efforts of eight sites associated with medical schools.[1]

Ruth T. Gross, Professor of Pediatrics at Stanford University, Jeanne Brooks-Gunn, Virginia and Leonard Marx Professor of Child Development and Education at Teachers College, Columbia University, Cecelia M. McCarton, Clinical Professor of Pediatrics, Albert Einstein College of Medicine, and Marie C. McCormick, professor and chair, Department of Maternal and Child Health, Harvard School of Public Health, headed teams composed of dozens of other independent analysts (the "IHDP evaluation team") in evaluating the IHDP, using random assignment and following the infants through age eighteen.

Program children exhibited early IQ gains that dissipated by age eighteen. At age eighteen, the heavier LBW children had statistically significant higher mathematics test scores on the Woodcock-Johnson Tests of Achievement-Revised compared to the control group. However, on every other measure, there were no statistically significant improvements. The cost of the program (about $18,250 per child, in 2005 dollars) was quite high relative to the modest benefits it seemed to confer.

## Program Design

**Program group.** The IHDP targeted LBW (less than 2,500 grams), preterm (gestational age of thirty-seven weeks or less) infants, because some studies have reported that such infants tend to have lower scores on cognitive tests at later ages and are at greater risk for behavioral problems and poor academic performance.[2]

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[1]The eight sites were: Little Rock, Arkansas; Bronx, New York; Boston, Massachusetts; Miami, Florida; Philadelphia, Pennsylvania; Dallas, Texas; Seattle, Washington; and New Haven, Connecticut.

[2]The Infant Health and Development Program, "Enhancing the Outcomes of Low-Birth-Weight, Premature Infants: A Multisite Randomized Trial," *Journal of the American Medical Association* 263, no. 22

Infants were screened for eligibility at eight participating sites and randomly assigned to a program or comparison group. At the time of enrollment, about 40 percent of the mothers had less than a high school degree and 53 percent were black. Although not limited to children from economically disadvantaged families, most of the children were from such families. Apparently, no data were collected or reported on family income.

**Services.** IHDP provided three primary services for eligible families from a child's birth through three years of age: home visits, parent support groups, and center-based education. Weekly home visits were provided from birth to one year, followed by biweekly visits when the child was between twelve and thirty-six months old. The home visits provided parents with (1) emotional, social, and practical support; (2) developmentally timed information about child development; (3) guidance in how to promote their child's intellectual, physical, and social development; and (4) help in caring for a developing and, initially, vulnerable child.[3] Parent group meetings provided information on child rearing and other parenting issues. IHDP also provided an intensive, center-based early education program for children between ages twelve and thirty-six months. Teacher-child ratios were low (1:3 for younger children and 1:4 for older children) and group sizes ranged from six to eight. Transportation was provided for families needing it.

Both program and control children received high-risk follow-up services consisting of a multidisciplinary team assessment every four to six months, as well as annual cognitive and behavioral assessments. Both groups were also referred to available community services.

**The Evaluation.** The IHDP was evaluated by a team composed of dozens of independent analysts headed by Ruth T. Gross, Professor of Pediatrics at Stanford University (for the first phase of evaluation); followed by Jeanne Brooks-Gunn, Virginia and Leonard Marx Professor of Child Development and Education at Teachers College, Columbia University (to age five); and Cecelia M. McCarton, Clinical Professor of Pediatrics, Albert Einstein College of Medicine (to age eight). A national study office guided the evaluation effort, setting up a National Advisory Committee and research staff at each of the study sites. The evaluation was conducted using random assignment in eight sites.[4]

IHDP had a total sample of 985 LBW infants (377 in the program group and 608 in the

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(June 13, 1990): 3035–3042.

[3]Craig T. Ramey, Joseph J. Sparling, Donna M. Bryant, and Barbara H. Wasik, "The Intervention Model," in *Helping Low Birth Weight, Premature Babies: The Infant Health and Development Program*, ed. Ruth T. Gross, Donna Spiker, and Christine W. Haynes (Stanford, CA: Stanford University Press, 1997), 20–21.

[4]The sites were selected based on the following criteria: (1) a medical school or affiliated hospital with an obstetric service and large enough number of births to enroll 135 infants and their families within 6 months; (2) a pediatric component to provide pediatric surveillance; and (3) a facility to provide educational services.

control group). The infants were recruited to achieve sample sizes that would permit stratification of the sample by birthweight. One-third of the sample was to have a birthweight between 2,001 and 2,500 grams (the heavier LBW group) and two-thirds of the sample was to have a birthweight of 2,000 grams or less. In addition, to minimize costs, two-thirds of the entire sample was to be assigned to the control group. The program attempted to recruit 135 infants from each site, 90 lighter infants and 45 heavier infants. Infants with serious health problems were excluded from the evaluation.

## Major Findings

IHDP children exhibited early IQ gains that dissipated by age five. Heavier LBW children had IQ gains that persisted through age eight but dissipated by age eighteen and had statistically significant higher mathematics test scores on the Woodcock-Johnson Tests of Achievement-Revised compared to the control group. However, on every other measure, there were no statistically significant improvements. The cost of the program (about $18,250 per child, in 2005 dollars) was quite high relative to the modest benefits it seemed to confer.[5]

**Cognitive.** The evaluation examined impacts on IQ and achievement.

*IQ.* By age three, IHDP produced a 10 point increase in mean IQs (94 vs. 84). These gains were larger for the heavier LBW program group children than the lighter LBW program group children (14 vs. 7) (see table 1). These gains were statistically significant at seven of the eight sites. The IHDP evaluation team speculates that the nonsignificant finding in one site "may be related to the sociodemographic characteristics of the site, such as the large proportion of college-educated mothers, as well as the relative abundance of community resources compared with the other sites."[6]

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[5]Unless otherwise noted, the findings described here are from: The Infant Health and Development Program, 3035–3042; Jeanne Brooks-Gunn, Cecelia M. McCarton, Patrick H. Casey, Marie C. McCormick, Charles R. Bauer, Judy C. Bernbaum, Jon Tyson, Mark Swanson, Forrest C. Bennett, David T. Scott, James Tonascia, and Curtis L. Meinert, "Early Intervention in Low-Birth-Weight Premature Infants: Results Through Age 5 Years From the Infant Health and Development Program," *Journal of the American Medical Association* 272, no. 16 (October 26, 1994): 1257-1262; Cecelia M. McCarton, Jeanne Brooks-Gunn, Ina F. Wallace, Charles R. Bauer, Forrest C. Bennett, Judy C. Bernbaum, Sue Broyles, Patrick H. Casey, Marie C. McCormick, David T. Scott, Jon Tyson, James Tonascia, and Curtis L. Meinert, "Results at Age 8 Years of Early Intervention for Low-Birth-Weight Premature Infants," *Journal of the American Medical Association* 277, no. 2 (January 8, 1997): 126-132; and Marie C. McCormick, Jeanne Brooks-Gunn, Stephen L. Buka, Julia Goldman, Jennifer Yu, Mikhail Salganik, David T. Scott, Forrest C. Bennett, Libby L. Kay, Judy C. Bernbaum, Charles R. Bauer, Camilia Martin, Elizabeth R. Woods, Anne Martin, and Patrick H. Casey, "Early Intervention in Low Birth Weight Premature Infants: Results at 18 years of Age for the Infant Health and Development Program," *Pediatrics* 117, no. 3 (March 2006): 771-780.

[6]Ruth T. Gross, "The Primary Child Outcomes," in *Helping Low Birth Weight, Premature Babies: The Infant Health and Development Program*, ed. Ruth T. Gross, Donna Spiker, and Christine W. Haynes (Palo Alto,

At age five, two years after the program ended, the overall differences disappeared and only the subgroup of heavier LBW children continued to demonstrate an advantage, although this dropped to 4 points. At age eight, the pattern of findings remained the same. By age eighteen, however, there were no statistically significant differences for either group of LBW children.

The IHDP evaluation team describes the limited significance of a 4 point IQ gain as follows: "Individually, 4 IQ points would not produce a functionally detectable difference between a child in the intervention group and one in the follow-up group."[7]

*Achievement.* At age eight, the heavier LBW program group had statistically significant higher scores on the Peabody Picture Vocabulary Test (PPVT) (92.4 vs. 85.7) and on the Woodcock-Johnson (W-J) math test (102.2 vs. 97.7). There were no significant differences in reading scores. At age eighteen, the IHDP evaluation team found that the heavier LBW program group had statistically significant higher scores on the mathematics portion of the W-J tests compared to the control group (94.9 vs. 89.8). There were no other statistically significant differences in achievement test scores.

**Table 1. Infant Health and Development Program: IQ Effects**

| Age (years) | Program group | Control group | Difference (percentage point) |
|---|---|---|---|
| Combined sample | | | |
| 3 | 94 | 84 | 10 |
| 5 | 92 | 91 | — |
| 8 | 91 | 91 | — |
| 18 | 90 | 91 | — |
| Heavier LBW | | | |
| 3 | 98 | 84 | 14 |
| 5 | 95 | 92 | 4 |
| 8 | 97 | 92 | 4 |
| 18 | 94 | 92 | — |
| Lighter LBW | | | |
| 3 | 92 | 84 | 7 |

CA.: Stanford University Press, 1997), 152.

[7]McCarton et al., 1997, 131.

| | | | |
|---|---|---|---|
| 5 | 90 | 91 | — |
| 8 | 88 | 90 | — |
| 18 | 89 | 90 | — |

*Sources:* Jeanne Brooks-Gunn, Cecelia M. McCarton, Patrick H. Casey, Marie C. McCormick, Charles R. Bauer, Judy C. Bernbaum, Jon Tyson, Mark Swanson, Forrest C. Bennett, David T. Scott, James Tonascia, and Curtis L. Meinert, "Early Intervention in Low-Birth-Weight Premature Infants: Results Through Age 5 Years From the Infant Health and Development Program," *Journal of the American Medical Association* 272, no. 16 (October 26, 1994): 1257–1262; Cecelia M. McCarton, Jeanne Brooks-Gunn, Ina F. Wallace, Charles R. Bauer, Forrest C. Bennett, Judy C. Bernbaum, Sue Broyles, Patrick H. Casey, Marie C. McCormick, David T. Scott, Jon Tyson, James Tonascia, and Curtis L. Meinert, "Results at Age 8 Years of Early Intervention for Low-Birth-Weight Premature Infants," *Journal of the American Medical Association* 277, no. 2 (January 7, 1997): 126–132; and Marie C. McCormick, Jeanne Brooks-Gunn, Stephen L. Buka, Julia Goldman, Jennifer Yu, Mikhail Salganik, David T. Scott, Forrest C. Bennett, Libby L. Kay, Judy C. Bernbaum, Charles R. Bauer, Camilia Martin, Elizabeth R. Woods, Anne Martin, and Patrick H. Casey, "Early Intervention in Low Birth Weight Premature Infants: Results at 18 years of Age for the Infant Health and Development Program" *Pediatrics* 117, no. 3 (March 2006): 771–780.
Notes: Only significant differences are reported. "—" indicates that the difference is not statistically significant at the 5 percent level. Age three scores are from Stanford-Binet; scores for ages five and eight are from Wechsler Preschool and Primary Scale of Intelligence tests.

**School readiness/performance.** The IHDP evaluation team found no statistically significant differences in either grade retention or special education placement at age eight (as reported by parents). The IHDP evaluation team hypothesized that differences in these outcomes may not materialize until the children are older, "when demands for academic performance are even greater."[8] However, in the age-18 follow-up, there were no significant differences on high school dropout rates or special education placements.

**Socioemotional development.** See below, under "Behavior."

**Health.** At age three, the IHDP evaluation team had more episodes of illness, but otherwise there were no statistically significant differences on other measures of health.

At the age five follow-up, there were no significant differences for morbidity or hospitalizations. At the age eight follow-up, children in the program group had a significantly lower score on a scale assessing impaired physical functioning due to health. There were no other statistically significant differences on seven other health measures. At the age eighteen follow-up, there were no statistically significant differences on two health checklist measures.

**Behavior.** Parent ratings on the Achenbach Child Behavior Checklist showed modest reductions in behavior problems at age three, primarily for heavier LBW children. At ages five, eight, and eighteen, however, there were no statistically significant differences between the

[8]McCarton et al., 1997, 131.

program and control group children.

**Crime/delinquency.** At age eighteen, there were no statistically significant differences in juvenile arrests or incarceration rates for either of the low birthweight groups.

**Early/nonmarital births.** Data apparently either not collected or not reported.

**Economic outcomes.** Data apparently either not collected or not reported.

**Effects on parents.** Mothers in the program group had higher employment levels during the three years of the project, but there were no significant differences in welfare receipt, school enrollment, or subsequent pregnancy.[9]

**Benefit-cost findings.** Given the modest impacts, the IHDP evaluation team raised the question of whether "the economic price involved in sustaining a 4-point IQ difference" for one subgroup at age eight, the heavier LBW children, was reasonable. No analysis, however, was possible because no consistent cost data were obtained across the sites. But, they estimated the combined cost of the various components plus ancillary costs, such as transportation, at about $18,250 per year per child (in 2005 dollars), with no measurable savings from reductions in grade retention or special education placements.[10] They hypothesized that these costs would be offset at least partially if program children had subsequent reductions in grade retention and special education placement. Even so, the effects would have had to be very large for the IHDP to have produced a positive return, even for the heavier LBW group.

**Overall Assessment**

IHDP was carefully evaluated in multiple sites and thus has broad generalizability, within the limits of its target population and intervention approach.

**Program theory.** This program was based on the premise that "on the whole LBW infants, particularly those born prematurely and extremely small, are at substantial elevated risk for mortality, and surviving, for myriad health, neurological, developmental, behavioral, social,

[9]Marie C. McCormick, Cecelia McCarton, Jeanne Brooks-Gunn, Patricia Belt, and Ruth T. Gross, "The Infant Health and Development Program: Interim Summary," *Journal of Developmental and Behavioral Pediatrics* 19, no. 5 (October 1998): 364.

[10]The only available cost figures for the program are for the Miami site in the final year of operation. Rebecca R. Fewell and Keith G. Scott, "The Cost of Implementing the Intervention," in *Helping Low Birth Weight, Premature Babies: The Infant Health and Development Program* ed., Ruth T. Goss, Donna Spiker, and Christine Haynes (Stanford, CA: Stanford University Press, 1997): 480–502.

learning, and other problems."[11] IHDP sought to reduce this risk through an early childhood intervention program based on models designed for normal-birth-weight infants from social disadvantageous circumstances.[12] Within this context, the evaluation is appropriate.

**Program implementation.** It appears that the intervention was well-implemented, with a relatively high utilization rate of services: 98 percent of families received home visits, 86 percent of children attended the day care center, and 78 percent of parents participated in a support group.[13] Most children (88 percent) began participating in the child development centers by the time they were fifteen months old.[14] Children spent about four to nine hours per day in the centers. On average, children in the program group participated in the child care component 267 days out of a possible 468 days, or about 57 percent.[15]

**Assessing the randomization.** Random assignment occurred during the nine-month period between October 1984 and August 1985. It was carefully monitored and no serious randomization problems were reported. The baseline characteristics of both the program and control group were comparable at initial random assignment, with no statistically significant differences on any of the characteristics examined.

*Recruitment.* Unlike most other early childhood intervention programs, IHDP attempted to identify all eligible infants at a site and sought to enroll them in the study. Of 4,551 infants screened across the eight sites, 1,302 were determined eligible.[16] Of the 1,302 eligible infants, 1,028 (76 percent) enrolled in the program (with enrollment rates that ranged from 56 percent to

[11]Alfred A. Baumeister and Verne R. Bacharach, "A Critical Analysis of the Infant Health and Development Program," *Intelligence* 23, no. 2 (September-October 1996): 79

[12]Baumeister and Bachrach, 1996, 82.

[13]McCormick et al., 1998, 362.

[14]Donna M. Bryant, Craig T. Ramey, Joseph J. Sparling, and Barbara H. Wasik, "The Child Development Centers," in *Helping Low Birth Weight, Premature Babies: The Infant Health and Development Program*, edited by Ruth T. Gross, Donna Spiker, and Christine W. Haynes (Palo Alto, CA: Stanford University Press, 1997), 44.

[15]Craig T. Ramey, Donna M. Bryant, Barbara H. Wasik, Joseph J. Sparling, Kaye H. Fendt, and Lisa M. LaVange, "Participation in the Intervention and Its Effect on the Cognitive Outcome," in *Helping Low Birth Weight, Premature Babies: The Infant Health and Development Program*, eds. Ruth T. Gross, Donna Spiker, and Christine W. Hayes (Stanford, CA: Stanford University Press, 1997), 193.

[16]The three main reasons for exclusion were residence outside the catchment area, gestation age greater than thirty-seven weeks, and hospital discharge outside the recruitment period. These three accounted for 80 percent of the exclusions.

88 percent across the eight sites) and were randomly assigned.[17] Although the loss of 274 children occurred before random assignment and does not affect the internal validity of the findings, it affects the generalizability of the findings. Two of the three most common reasons given for refusing consent were "do not want day care" and "program not needed; no special needs perceived."[18] The IHDP evaluation team noted that mothers who were Hispanic or black and who had lower birthweight infants were more likely to enroll in the program, but concluded that the refusal rate did not raise serious concerns over the external validity of the findings.

*Post random assignment attrition.* Forty-three of the 1,028 randomly assigned families were dropped from the "primary analysis group," because twenty-six of them could not be located and seventeen refused to participate (fourteen in the program group and three in the control group).[19] The failure to locate twenty-six families may be random, but the disproportionate share of refusals in the program group suggests differential attrition. Because the number is small and represents less than 2 percent of the entire sample, this is not a serious concern. (By contrast, in the Abecedarian Project [see chapter 1], post random assignment refusals accounted for 7 percent of the entire sample and nearly 15 percent of the program group.)

*Crossovers.* The IHDP evaluation team noted that the occurrence of "crossovers" may have understated the impact of IHDP, since 30 percent of the control group children entered a community day care center by thirty-six months and 14 percent of program group children never entered such an arrangement. As it explains, "the effect of such 'crossovers' would be to reduce the apparent magnitude of the effect of intervention; i.e., the actual intervention effects might be somewhat larger than those we have documented."[20] The key policy question, however, is the impact of the program compared to what otherwise would have been available. To that extent, the participation of control group children in other early childhood programs is not an issue.

Similarly, the fact that 14 percent of program group children did not participate in a center-based care program represents a form of "crossover" to the control group, and also may have affected impacts. (Even this exaggerates nonparticipation, however, since the families may have participated in other components of the program.) If the idea is to estimate the likely effects

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[17]Wendy L. Constantine, Christine W. Haynes, Donna Spiker, Kathleen Kendall-Tackett, and Norman A. Constantine, "Recruitment and Retention," in *Helping Low Birth Weight, Premature Babies: The Infant Health and Development Program*, edited by Ruth T. Gross, Donna Spiker, and Christine W. Haynes (Palo Alto, CA: Stanford University Press, 1997), 131.

[18]Constantine et al., 1997, 135.

[19]Helena C. Kraemer and Kaye H. Fendt, "Random Assignment in Clinical Trials: Issues in Planning," in *Helping Low Birth Weight, Premature Babies: The Infant Health and Development Program*, edited by Ruth T. Gross, Donna Spiker, and Christine W. Haynes (Palo Alto, CA: Stanford University Press, 1997), 112.

[20]Gross, 151.

of the program in the real world, such nonparticipation is consistent with likely variations in an uncontrolled situation. (To isolate the impact on actual participants, the evaluators could have calculated the per participant impact by dividing the experimental impact by the participation rate, as did the evaluators of the Early Head Start program, see chapter 6.)[21] This would have a relatively modest effect, given the high participation rate.

**Assessing statistical controls in experimental and nonexperimental evaluations.** IHDP was evaluated using random assignment, so selection bias should not be a serious problem. In addition, the IHDP evaluation team used regression analysis to control for the small baseline differences that existed and to improve the precision of the estimates.

One of the criteria for selecting the evaluation sites was the quality of their follow-up programs for premature infants. This selection factor may have favorably biased the results, since areas without such programs might have had a weaker performance.

**Sample size.** The sample of 985 children was relatively large, permitting overall estimates of the impact of IHDP, as well as impacts for two subgroups: lighter LBW and heavier LBW children. The sample sizes within sites permitted site-level estimates for the overall intervention group, but were not large enough to examine effects within birthweight strata. IHDP sample sizes at each site paralleled those of the Abecedarian Project (see chapter 1), High Scope/Perry Preschool Program (see chapter 14), and many other model programs.

**Attrition.** Attrition was significant. The last follow-up was conducted when the children were eighteen years old. At that time, 636 children (65 percent) were evaluated, with 254 (68 percent) in the program group and 382 (63 percent) in the control group. Attrition varied by study site, and differences in attrition in maternal education and race were statistically significant, with children who had mothers with less than a high school education at the time of birth and children who were racial or ethnic minorities being less likely to participate in the follow-up.

**Data collection.** The data collection relied on various standardized tests and parent surveys. The data sources were appropriate for the questions being studied.

**Measurement issues.** The IHDP evaluation team used standard cognitive and achievement tests. One question surrounding standardized tests is whether early childhood programs teach materials that are similar to items found on the test. The team notes that, "The intervention curriculum and cognitive instruments were selected independently, and as a further precaution, the protocol denied specific feedback to the education staff on the child's cognitive

[21]U.S. Department of Health and Human Services, Administration for Children and Families, Administration on Children, Youth and Families, *Building Their Futures: How Early Head Start Programs Are Enhancing the Lives of Infants and Toddlers in Low-Income Families, Summary Report* (Washington, DC: U.S. Department of Health and Human Services, January 2001).

test performance."[22] Even if selected independently, the "fade out" of IQ impacts suggests the possibility that the intervention taught some of the types of items found on the test, which could explain the larger impacts at younger ages.

Measures of school performance and children's behavior were based on parent reports. Parental perceptions of their child's behavior may have been influenced by their participation in the program, so differential program effects could be a function of differences in perceptions rather than actual child behavior. The IHDP evaluation team, however, reports that "other studies involving maternally reported behavior problems at this age indicate that such reports correspond to clinically detected problems and may be predictive of longer-term adverse outcomes."[23]

**Generalizability.** Marie McCormick, who was one of the evaluators and is a professor and chair of the Department of Maternal and Child Health at Harvard University's School of Public Health, suggests that—though the IHDP findings are limited to LBW children—they could be considered suggestive for low-income families with normal birthweight children, especially since those with serious health problems were excluded from the research (biasing the sample toward healthy children).[24] She explains:

> LBW children do not have special or unique problems. They are at higher risk for most of the common and not so common health problems experienced by normal birth weight children. The sample is more generalizable than most model programs tested in a single site, because it is more heterogenous for biologic and socio-economic risk.[25]

This may be true, but before agreeing to such a conclusion, one would need specific data on the question.

Some selection bias, however, may have arisen from the site selection criteria. As David Greenberg, professor of economics at the University of Maryland-Baltimore County, and Mark Shroder, economist at the U.S. Department of Housing and Urban Development, point out, "The research sites were chosen for their ability to conduct good research, rather than based on a probability sample, but findings should otherwise be generalizable to the national population of

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[22]The Infant Health and Development Program, 3041.

[23]The Infant Health and Development Program, 3041.

[24]Other exclusion factors included "excessive distance of the infant's home from the site and certain maternal characteristics which would preclude full participation in the program (such as limited knowledge of English, substance abuse problems, or psychiatric hospitalization)."

[25]Marie McCormick, e-mail message to Peter Germanis, March 7, 2001.

low-birthweight children and their families."[26]

**Replication.** Although IHDP itself has not been replicated, the multisite approach could be considered eight independent replications.

**Evaluator's description of findings.** The initial findings led the IHDP evaluation team to conclude that this "comprehensive and intensive early intervention program shows substantive promise of decreasing the number of LBW premature infants at risk for later developmental disability."[27] The subsequent declines in program impact proved this conclusion to be premature. The absence of persistent findings when the children were age eight led the evaluators to hypothesize that the intervention may have ended too soon to sustain long-term impacts because "the biomedical problems were greater in this group of children." Although this is possible, it is also possible that the intervention was simply not effective.

There were some persistent impacts for the subgroup of heavier LBW children "whose developmental trajectory is quite similar to normal birth-weight children."[28] Moreover, the cognitive and school performance effects were somewhat comparable to those found in the Abecedarian Project, after which IHDP was modeled. The IHDP evaluation team suggested that some improvements in school performance might materialize later, when the children were older, but this is only speculation.[29]

**Evaluator's independence.** The IHDP was evaluated by a team of independent analysts headed by Ruth T. Gross, Professor of Pediatrics at Stanford University (for the first phase of evaluation); followed by Jeanne Brooks-Gunn, Virginia and Leonard Marx Professor of Child Development and Education at Teachers College, Columbia University (to age five); Cecelia M. McCarton, Clinical Professor of Pediatrics, Albert Einstein College of Medicine (to age eight); and Marie C. McCormick, professor and chair, Department of Maternal and Child Health, Harvard School of Public Health (to age eighteen). Moreover, the IHDP database has been made available to other analysts for independent analysis.

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[26]David Greenberg and Mark Shroder, *The Digest of Social Experiments* (Washington, DC: The Urban Institute Press, 1997), 244.

[27]The Infant Health and Development Program, 3041.

[28]Institute for Research on Poverty, "Do Intervention Programs for Young Children Reduce Delinquency and Crime?" *Focus* 19 (Summer/Fall 1997): 15.

[29]Subsequent follow up will examine this issue.

Development, U.S. Public Health Service, National Institute of Child Health and Human Development; the Pew Charitable Trusts; and the Center for the Study of Families and Children at Stanford University."[30]

**Statistical significance/confidence intervals.** Statistical significance was measured and reported at the 1 percent and 5 percent levels.

**Effect sizes.** Apparently effect sizes were either not calculated or not reported.

**Sustained effects.** The evaluation examined impacts through age eighteen, about five years after program completion.

**Benefit-cost analysis.** Apparently not performed.

**Cost-effectiveness analysis.** Apparently not performed.

[30]Ruth T. Gross and Donna Spiker, "The National Study Office: Structure and Function," in *Helping Low Birth Weight, Premature Babies: The Infant Health and Development Program* ed., Ruth T. Goss, Donna Spiker, and Christine Haynes (Stanford, CA: Stanford University Press, 1997): 362.

# Commentary

Marie C. McCormick and Jeanne Brooks-Gunn*

The Infant Health and Development Program is unique among the early childhood education (ECE) programs described in this volume. Of most import is the fact that the same intervention was mounted in eight sites. No other ECE program evaluation has done so (even though multi-site evaluations have been conducted). For example, the Parent Child Development Centers (PCDCs), while conducted in three sites, did not use the same curriculum nor were teachers trained together across sites. In the Comprehensive Child Development Program (CCDP), sites were free to implement services (primarily case management and home visiting) in a variety of ways. This flexibility led to huge variation in number of home visits and differences in the composition of the team (for example, a child developmental specialist might not be present, or the case manager and home visitor were the same person).[1] Likewise, The Early Head Start Program evaluation includes 17 sites, each of which had a slightly different focus (in terms of expected outcomes for parents and children), used various curricula, and provided a different blend of services.[2] Perhaps most gratifying is the fact that these centers were all developed de novo, that is, none of the eight sites had run ECE programs previously (unlike many CCDP and Early Head Start sites, which has been Head Start sites before). At the same time, it might be easier to gain consistency across sites with no past history.

Not only was it possible to implement the same program in IHDP, but the findings across the sites were quite similar (that is, significant effects on child outcomes at the end of the intervention when the children were three years old in all but one site, a point to which we will return). What is particularly heartening is the fact that ECE programs actually can be implemented similarly across sites and that high levels of child care and home visiting can be maintained.[3] In addition, a standard curriculum was used across sites (a limitation of ECE in general is the lack of

*Jeanne Brooks-Gunn is Virginia and Leonard Marx Professor of Child Development and Education and Teachers College, Columbia University. Marie C. McCormick is professor and chair, Department of Maternal and Child Health, Harvard School of Public Health.

[1]Jeanne Brooks-Gunn, Margaret Burchinal, and Michael Lopez, "Enhancing the Cognitive and Social Development of Young Children via Parent Education in the Comprehensive Child Development Program," (unpublished paper, 2001).

[2]Love et al., this volume.

[3]Fong-ruey Liaw, Samuel J. Meisels, and Jeanne Brooks-Gunn, "The Effects of Experience of Early Intervention on Low Birth Weight, Premature Children: The Infant Health and Development Program," *Early Childhood Research Quarterly* 10, no. 1 (March 1995): 405-431.

specification of the actual program; IHDP has provided more detail on the "black box" of its intervention than other programs).

Other distinctive features are the inclusion of young children from a variety of socioeconomic backgrounds and from two different groups of low birth weight (LBW) children. The results from several secondary analyses indicate that the IHDP was not particularly effective for mothers who were college educated, but was effective for mothers with less than a high school education or with a high school degree.[4] A cluster analyses of IHDP children based on infant developmental scores at ages one, two, and three demonstrates this point elegantly. One cluster was described as "high stable," meaning that developmental test scores were relatively high across the three age points. When we looked at the children whose mothers had low educational levels, those who were in the "high stable" group were virtually all in the intervention group. In contrast, children whose mothers had attended college were equally likely to be in the intervention and follow-up only group.[5] These findings present the only evidence that ECE programs are more beneficial to less educated (and low-income) parents, groups for whom ECE programs such as Head Start and Early Head Start were developed. They also illuminate why one site did not produce significant effects (as the site served relatively higher SES families).

The results for the two different groups of LBW children are also informative. Effects at age three were stronger for those with heavier than the lighter low birth weight children, and sustained effects at ages five and eight were only seen in the heavier LBW group. We have speculated that either the lighter LBW infants needed more sustained intervention (that is, lasting longer than the first three years) or that these infants have more biological problems than their heavier counterparts (children from 2000-2500 grams at birth are almost indistinguishable from those who weigh over 2500 grams at birth).[6] While the design of IHDP does not allow us to test the differences in intensity, within treatment group analyses (comparing to the follow-up only group via propensity matching techniques) suggest that the lighter LBW infants who attended the center for 400 days or more exhibited sustained effects.[7]

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[4]Jeanne Brooks-Gunn, Ruth T. Gross, Helena C. Kraemer, Donna Spiker, and Sam Shapiro, "Enhancing the Cognitive Outcomes of Low Birthweight, Premature Infants: For Whom Is the Intervention Most Effective?" *Pediatrics* 89 (1992): 1209–1215.

[5]Fong-ruey Liaw and Jeanne Brooks-Gunn, "Patterns of Low Birth Weight Children's Cognitive Development and Their Determinants," *Developmental Psychology* 29 (1993): 1024–1035.

[6]Marie C. McCormick, Jeanne Brooks-Gunn, K. Workman-Daniels, J. Turner, and G. Peckham, "The Health and Developmental Status of Very Low Birth Weight Children at School Age," *Journal of the American Medical Association* 267 (1992): 2204–2208.

[7]J. Hill, Jane Waldfogel, and Jeanne Brooks-Gunn, "Dosage Effects in an Early Intervention for Low Birth Weight Premature Infants: Impact Through Age 8 Years from the IHDP" (unpublished paper, 2001).

We believe that the sustained effects for the heavier LBW infants are meaningful. The effects are largest for verbal components of development: the differences in scores for the PPVT-R (Peabody Picture Vocabulary Test-Revised) are 6.0 at age five and 6.7 at age eight, and the corresponding numbers for the Verbal Scales of the WPPSI and WISC are 4.2 at both ages. While scholars may differ as to their interpretation of the size of these effects (that is, about one-third of a standard deviation), the size is similar to what was found in the Abecedarian Project, which has reported sustained effects through the adolescent years.[8] In contrast to the Abecedarian Project, IHDP was run for three instead of five years. It is possible (though not testable) that even larger effects might have been seen if IHDP provided center-based care services in the fourth and fifth year of the child's life. Indeed, not all children continued in center-based care when the program ended.[9]

Perhaps the most important concern about the description of IHDP in this volume is that the assessment of cost-effectiveness is either too late or premature. If the "effect" is difference in IQ between the ECE group and comparison, it is not clear why the results at three years of age are not more relevant than at eight, since the program could not control for the intervening experience of the children. The concern about a premature assessment stems from longer term follow-up studies of antecedent programs, which indicate much greater advantages to those in early childhood educational programs in late adolescence and young adulthood. Significant effects have been documented by the teenage years on the receipt of special education (Early Training Project, Perry Preschool Project, and the Abecedarian Project), with fewer treatment children having been placed in special education classes. Fewer instances of grade repetition were reported by the adolescent years for the Chicago CPC and the Abecedarian Project, but not the Early Training, Perry Preschool, Houston Parent Child Development Center, or Syracuse Family Development Research Project. Interestingly, the Perry Preschool did report that more children in the treatment group had graduated high school by age twenty-seven than those in the control group (with a similar report just being announced for the Abecedarian Project).[10] Thus, effects on grade retention and high school graduation are seen, although differences across projects may be associated with cohort effects (that is, changes in the past fifteen years as to grade retention and high school graduation policies as well as state differences in such policies).

With regard to problem behavior, five of the programs have examined juvenile

[8]Ramey et al., this volume.

[9]Tama Leventhal, Jeanne Brooks-Gunn, Marie C. McCormick, and Cecilia M. McCarton, "Patterns of Service Use in Preschool Children: Correlates, Consequences, and the Role of Early Intervention," *Child Development* 71 (2000): 800–817.

[10]Frances A. Campbell, Craig T. Ramey, Elizabeth Pungello, Joseph Sparling, and Shari Miller-Johnson, "Early Childhood Education: Young Adult Outcomes from the Abecedarian Project," *Applied Developmental Science* 6, no. 1 (January 2002): 42–57

delinquency, with four of the five reporting lower rates in the group of children receiving the early intervention.[11] These findings have received wide publicity in the media as well as in the field of education. We do not know if similar results will be seen in the IHDP, vis-a-vis delinquency. Longer-term follow-up into the early adulthood years might be necessary to see such effects, if they exist.

Interestingly, no studies have collected data on the incidence of severe behavior problems and psychiatric symptoms. One might expect that the incidence of certain problems might be reduced via early childhood interventions. The most likely to be influenced are aggressive behavior, and possibly hyperactivity. In the IHDP, we did find a significant reduction in the severity of child behavior problems at age three and continuing to age five for the heavier LBW.[12] Somewhat surprisingly, no effects were seen at age eight, although we have not conducted analyses by gender, income group, and the like, to see if sustained effects might exist for some specific subgroups.

To address the question of later effects of ECE, we are currently beginning a follow-up of the subjects of IHDP at seventeen years of age. The follow-up will examine four major questions. The first is the effect of participation in an intervention consisting of an early child development program and family support services on engagement and motivation to continue in school, adolescent behavior/mental health, cognitive and linguistic abilities, and health status. Of interest will be subgroup differences, for example by birth weight strata or socioeconomic status. The second question will examine this question from the premise of differences in trajectories in view of the multiple measures over time in some domains.

The third and fourth questions deal with potential changes in the mother due to participation in such a program. Here we will be asking whether participation in an ECE program will affect the mothers' child-rearing attitudes and behavior in terms of effective supervisory

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[11]Craig T. Ramey and Frances A. Campbell, "Poverty, Early Childhood Education and Academic Competencies: the Abecedarian Experiment," in *Children in Poverty: Child Development and Public Policy*, ed. Aletha C. Huston (New York: Cambridge University Press, 1991); Frances A. Campbell and Craig T. Ramey, "Effects of Early Intervention on Intellectual and Academic Achievement: A Follow-up Study of Children from Low-Income Families," *Child Development* 65 (1994), 684-698; Hirokazu Yoshikawa, "Long-Term Effects of Early Childhood Programs on Social Outcomes and Delinquency," Future of Children 5, no. 3 (1995): 51–75; Craig T. Ramey and S.L. Ramey, "Early Intervention and Early Experience," *American Psychologist* 53 (1998): 109–120.

[12]The Infant Health and Development Program: "Enhancing the Outcome of Low- Birth-Weight, Premature Infants: A Multi-Site, Randomized Trial," *Journal of the American Medical Association* 263 (1990): 3035–3042; Jeanne Brooks-Gunn, Cecelia M. McCarton, Patrick H. Casey, Marie C. McCormick, Charles R. Bauer, Judy C. Bernbaum, Jon Tyson, Mark Swanson, Forrest C. Bennett, David T. Scott, James Tonascia, and Curtis L. Meinert, "Early Intervention in Low-Birth-Weight Premature Infants: Results Through Age 5 from the Infant Health and Development Program," *Journal of the American Medical Association* 272 (1994): 1257–1262.

attitudes and strategies, aspirations for their children, and coping and mental health. If so, is this effect restricted to the study child? Or do these changes influence the development of younger siblings born after the study child through the changes noted above? If the results of these analyses continue to demonstrate positive effects of the intervention, then the cost-effectiveness argument is changed sharply.

But should cost-effectiveness arguments be the sole basis for assessing the effectiveness of early educational interventions? It is a very conservative standard, since the largest potential cost-savings are measured in terms of completed years of education, crime, teenage parenthood, and incarceration, all of which cannot be measured until the transition to adulthood. If it is not to take decades, then we need another measure of effect. Further, ECEs are not "immunizations" that insure protection against other threats to child development like poor schools and disorganized neighborhoods. Rather cannot we conclude from the programs in this volume that we have "proof of principle" that interventions can enhance child outcomes across a range of vulnerabilities? If so, let's get on with it.

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