



The Effect of the Infant Health and Development Program on Special Education Use at School Age

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Objectives To evaluate the effect of an intensive early intervention on special service use at school-age.

Study design The Infant Health and Development Program was a randomized controlled trial of an intervention for low birth weight (<2500 g) infants ages 0-3 years. We used multivariate logistic regression to test the association between intervention and risk of special education, remedial reading and math, and speech therapy at age 8 years. We also compared rates of service use between study arms among those with learning disabilities (LDs).

Results There were 875 complete cases at 8-year follow-up. There were no statistically significant differences between groups in risk of special education (risk ratio [RR] 0.86, 95% CI 0.64-1.15), remedial reading (RR 0.88, 95% CI 0.68-1.14), remedial math (RR 0.92, 95% CI 0.63-1.34), or speech therapy (RR 0.87, 95% CI 0.62-1.23). The treatment arms did not differ in rates of LDs, and service use for those with LDs was low and unaffected by study group.

Conclusions Early gains in IQ from infant interventions may not protect children as they face the educational demands of grade school. Only a fraction of those having a LD were receiving school-based support services, indicating a high level of unmet need among low birth weight children with disabilities. (*J Pediatr* 2015;166:457-62).

Low birth weight (LBW) is associated with increased risk of intellectual impairment and learning disabilities (LDs) for school-age children.¹⁻⁶ Up to 13% of children born <1000 g and 20% born <750 g have intellectual delays, defined as an IQ <2 SD below the mean on neuropsychologic testing. These differences persist even when neurosensory impairment, neurologic injury, and sociodemographic risk factors are taken into account.⁷ LBW also is associated with high rates of disability in both reading and math.^{8,9} Children with LBW also are more likely to receive special education and be held back a grade compared with normal birth weight peers.¹⁰ These differences are especially pronounced in infants who are male, non-white race, and low socioeconomic status.^{6,7}

The extent to which such educational problems can be prevented is uncertain. Studies in healthy, term disadvantaged children demonstrate that preschool educational intervention results in greater IQs in the short term and better school achievement and completion in the longer term.¹¹⁻¹³ However, only the Chicago Child-Parent Center Program has examined the effect of early intervention on the need for special education services. In that study, economically disadvantaged urban children randomized to participate in a half-day preschool program emphasizing school readiness skills had lower rates of special education placement compared with control patients (12.5% vs 18.4%).¹⁴

Whether these results would also pertain to premature infants remains to be seen. The Infant Health and Development Program (IHDP) is one of few, multisite, randomized trials that investigated the efficacy of intensive early-childhood intervention in improving the developmental outcomes of infants with premature LBW. Like studies in term, poor children, infants in the intervention group had greater IQ scores by almost 10 points and fewer behavior problems compared with those in the control group at age 3 years.¹⁵ At 5 years of age, the mean IQ score for the intervention group was 91.6 and that for the comparison group was 91.4. By 8-year follow-up, the mean IQ score for the intervention group was 90.8 and that for the comparison group was 88.3. Neither of these differences was statistically significant¹⁶; however, subgroup analyses revealed persistent IQ differences for infants born weighing 2001-2499 g.¹⁶

Early childhood intervention programs may benefit children in domains beyond those typically measured by intelligence testing. The aim of this study was to evaluate the effect of IHDP participation on use of special education services in early school-age among premature children with LBW. We hypothesized that: (1) the children randomized to the IHDP intervention group were less likely to use special education services at age 8 years compared with those randomized to usual follow-up care; (2) participation in the intervention would have greater benefits for boys, nonwhite participants, and those in low socioeconomic status

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IHDP	Infant Health and Development Program
LBW	Low birth weight
LD	Learning disability
RR	Risk ratio

families because of known disparities between special education service need and service use in the LBW population; and (3) to explore differences between rates of LDs and actual service use by IHDP treatment arm in the study sample.

Methods

The IHDP was a randomized, controlled trial of an intensive early intervention for infants with LBW. The details of the protocol have been published previously and will be summarized here.¹⁵ Infants with birth weight <2500 g and gestational age <36 completed weeks and free of impairments that would limit participation in the intervention were recruited from 8 US medical centers between January 7 and October 9, 1985. The sample was recruited in 2 preplanned strata: one-third was in a 2001- to 2499-g “heavier” group and two-thirds in a 2000-g “lighter” group. One-third of the total sample was randomized to the intervention, and two-thirds was randomized to the control.¹⁶

The intervention program began at time of hospital discharge and continued until age 36 months' corrected age. Both intervention and control infants received high-risk follow-up care with at least annual developmental testing and referral to all available services in the community. The intervention consisted of 3 components: home visits, attendance at child care centers, and parent meetings.¹⁷ The first 2 components relied on a standardized curriculum.^{17,18}

All children were assessed at multiple time points. Assessments consisted of standardized questionnaires administered during face-to-face interviews with participants and caregiver in addition to neuropsychological testing. The primary study outcome was IQ, measured by the Stanford-Binet Intelligence Scale.¹⁹ In the follow-up assessment of the cohort at age 8 years, intelligence was measured by the Wechsler Intelligence Scale for Children-III.²⁰ Achievement was measured at this time point by the Woodcock-Johnson Tests of Achievement-Revised.²¹ Information regarding child school placements and receipt of special education and support services was acquired via follow-up interviews with both caregivers and teachers at ages 5, 6.5, and 8 years. Family demographic information and child health status were also updated during these interviews. The experimental protocol was approved by the Institutional Review Board at Boston Children's Hospital.

Statistical Analyses

Our main interest was whether randomization to the IHDP intervention arm from birth to 36 months of age would have an impact on the use of special education services at school age. The primary outcomes for this study are the rates at which premature children with LBW received special education (defined as being classified for special education and having an Individual Education Plan), remedial math and reading services, and speech therapy. Each of these was measured via a dichotomous yes-no question during caregiver and teacher interviews at age 8 years.

We fit multivariate logistic regression models to assess the relationship between IHDP group assignment and the 4 outcomes of interest. To account for the potential clustering of outcomes by study site, we included indicator variables for study site.

We also were interested in assessing effect modifiers of the IHDP treatment effect by adding interaction terms between treatment group assignment and sex, race, birth weight group and maternal age, education, and marital status in separate regression models. Because of the possibility of differential treatment effects by study site, we fit a logistic regression model including an interaction term between treatment group and study site as well.

Finally, we were interested in comparing service use and service need at early school age. We identified children needing special education services as those meeting a discrepancy-based definition of LD as determined by low achievement relative to IQ. Expected achievement scores were derived from regression equations relating IQ and achievement in the control group at age 8 years. LD was defined as a discrepancy of 15 points or more between actual and predicted achievement standard scores on Woodcock-Johnson Tests of Achievement-Revised reading, math, or both reading and math subscales, a widely used criterion by schools.²² We used χ^2 tests to compare IHDP treatment groups on rates of service use among those with LD.

Results

Sample demographic characteristics are described in **Table I**. Of the 985 individuals in the primary analytic sample participating in the initial trial, 913 participated in follow-up at 36 months' corrected age. In follow-up at age 8 years, 970 participated, and 875 had complete outcomes data, 338 in the IHDP group and 537 in the comparison group (**Figure**; available at www.jpeds.com). Children with missing data did not differ significantly from those retained in the analytic sample with respect to study group, birth

Table I. Baseline characteristics of the sample by study group

Total sample	IHDP, n (%)	Follow-up, n (%)
Birth weight	338	537
2001-2500 g	120 (36)	193 (36)
≤2000 g	218 (64)	344 (64)
Male	167 (49)	265 (49)
Race		
White	128 (38)	200 (37)
Black	177 (52)	383 (53)
Hispanic	32 (9)	53 (10)
Maternal age, y		
≤21	119 (35)	178 (33)
Maternal education		
Less than high school	16 (5)	12 (2)
High school diploma	122 (36)	181 (34)
Some college	97 (29)	154 (22)
College diploma	60 (18)	120 (22)
Maternal marital status		
Married	154 (47)	256 (49)

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