Inner-city Achievers

Who Are They?

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Objective: To define characteristics that differentiate inner-city children with Average or above-Average Full Scale IQ scores (≥90) from those with below-Average scores (<90).

Design: As part of a prospective study of children with and without in utero cocaine exposure tested at age 4 years on the Wechsler Preschool and Primary Scales of Intelligence–Revised, we found that, taken together, only 32 (21%) scored at or above 90 whereas 118 (79%) scored below 90. The groups (IQ ≥90 and IQ <90) were compared on prenatal, natal, and postnatal factors.

Setting: A study center in an inner-city hospital.

Participants: One hundred-fifty children of low socioeconomic status, 34 weeks' gestational age or older, and nonasphyxiated at birth, who had intelligence testing at age 4 years; 150 caregivers (biological and foster).

Main Outcome Measures: Association of Full Scale IQ with prenatal, natal, and postnatal characteristics (including caregiver-child interaction measured by the Parent Caregiver Involvement Scale [PCIS], and home environment measured by the Home Observation for Measurement of the Environment [HOME]).

Results: The group of children with IQs at or above 90 (n = 32) did not differ from the group with IQs below 90 (n = 118) in prenatal or natal characteristics (all P ≥.18) or proportion in foster care, attendance at day care or Head Start, continued caregiver cocaine use, or parental IQ. Children with IQs at or above 90 had more developmentally appropriate interaction by caregivers (P = .043) and higher scores on 6 of 8 subscales and Total HOME (P ≤.05) than the group of children with IQs below 90.

Conclusions: Two postnatal factors, home environment and caregiver-child interaction, were associated with Full Scale IQ scores at or above 90 whereas prenatal and natal factors were not. These potentially malleable postnatal factors can be targeted for change to improve cognitive outcome of inner-city children.


Editor’s Note: This study can help to reform the damage resulting from political and general misinformation. I hope it will help to redirect our health policy to the potential and real strengths of inner-city families.

Catherine D. DeAngelis, MD

In a prospective, longitudinal evaluation of inner-city children of low socioeconomic status enrolled at birth, half of whom were exposed to cocaine in utero and half of whom were not, we hypothesized that the cocaine-exposed children would have lower Full Scale IQ scores (Wechsler Preschool and Primary Scale of Intelligence–Revised [WPPSI-R]) at age 4 years. However, we found no difference in scores between 72 cocaine-exposed children (79.2 ± 12.7 [mean ± SD]) and 78 controls (81.9 ± 10.7) (P = .16).1

While there was no difference between scores of cocaine-exposed children and controls, both groups had mean Full Scale scores falling well below the Average range (90-109) of the WPPSI-R. In fact, of the 150 children tested (cocaine-exposed and control taken together), only 32 (21%) scored Average or above (mean Full Scale score, 96.9 ± 5.9) while 118 (79%) scored below Average (mean Full Scale score, 76.2 ± 8.6) (Figure, Table 1). Because such a small percentage of these inner-city children scored Average or above, our aim was to define maternal, natal, and postnatal characteristics that differentiated these inner-city achievers with Average or above-Average Full Scale IQ scores on the WPPSI-R from those children who scored below Average. Because postnatal environment has been found to contribute to cognitive development, we
PARTICIPANTS AND METHODS PARTICIPANTS

As part of the prospective study comparing the outcome of children exposed to cocaine in utero and controls (all ≥34 weeks’ gestational age and with 5-minute Apgar scores ≥5), numerous prenatal, natal, and postnatal characteristics have been documented. Full details of enrollment criteria are described elsewhere. Given this broad data base, we compared the 32 children with IQs at or above 90 and 118 children with IQs below 90 on the following: Maternal Factors—pregnancy data, educational level at delivery and substance use (cigarettes, alcohol, and marijuana, all self-report; cocaine, amphetamines, barbiturates, benzodiazepines, and opiates, all self-report, and urine screen). Mothers who used substances other than cocaine, marijuana, alcohol, or cigarettes were excluded; Natal Factors—gestational age, birth weight, Apgar score, admission to the neonatal intensive care unit, cranial ultrasonograms findings, and discharge to biological mother; and Postnatal Factors—primary caregiver (biological or foster [kinship or other]), parental IQ, caregiver educational level at time of WPSSI-R administration, continued caregiver cocaine use, and attendance at day care or Head Start. Caregiver-child interaction was assessed using the Parent/ Caregiver Involvement Scale (PCIS) (D. C. Farran, PhD, C. Kasari, NDT, PhD, M. Comfort, PhD, S. Jay, PhD, unpublished manual, 1986) and the environment, using the Home Observation for Measurement of the Environment (HOME). Ongoing assessments of caregiver intelligence are being administered by examiners masked to subject group assignment using the Wechsler Adult Intelligence Scale—Revised (WAIS-R). While all caregivers are assessed with the WAIS-R, only scores for the biological mother or father are included in these analyses. Current caregiver educational level was obtained from a structured interview administered at follow-up appointments. Urine drug screens were collected from the caregivers at the time of follow-up visits and analyzed for cocaine metabolites using a fluorescent polarization immunoassay (Abbott Laboratories, Chicago, Ill). The PCIS, constructed to provide an assessment of the quality, appropriateness, and general impression of the caregiver’s involvement in dyadic play, was administered to children and their caregivers during a videotaped 20-minute session within 6 months of the child’s fourth birthday. This instrument was chosen because it measures caregiver-child variables in a setting that simulates play experiences at home. The PCIS has good psychometric properties, including good reliability and standardization with a wide range of children, both normal and handicapped, through 5 years of age; it has been used effectively with lower socioeconomic status, minority children (see references 12 through 14 and D. C. Farran, PhD, C. Kasari, NDT, PhD, M. Comfort, PhD, and S. Jay, PhD, unpublished manual, 1986). Videotapes of the sessions were rated by individuals masked to subjects’ group status. The HOME, a 1-hour structured interview and observation of the home environment, was conducted when the child was 4 years old by a visitor masked to the child’s group status. This study was approved by the Institutional Review Board of the Albert Einstein Medical Center, Philadelphia, Pa. Informed consent was obtained from all caregivers; remuneration was given for participation.

DATA ANALYSIS

As in previous publications, children were considered with their biological mother if she had been their caregiver for at least 75% of their lives and in foster care if the children had spent 25% or less of their lives in the care of their biological mothers. The 11 children in the care of their mothers 26% to 74% of their lives were not included in the analysis of PCIS. Children with IQs at or above 90 and those with IQs below 90 were compared using Fisher’s exact test for binary variables such as in utero drug exposure; t tests for continuous variables such as birth weight and age at testing; and Mann-Whitney U tests for 5-minute Apgar score and HOME scores (several of the HOME subscales were skewed to the right). Forced-entry multivariable logistic regression was performed to determine which variables distinguished children with IQs at or above 90 from those with IQs below 90. Statistical analyses were performed using SPSS 6.1.3 for Windows (SPSS Inc, Chicago, Ill).

RESULTS

The 32 children with IQs at or above 90 did not differ from the 118 children with IQs below 90 in maternal or in neonatal characteristics (Table 2; all P ≥ .18). The median days of cocaine use in pregnancy was 99 for both the 16 caregivers of children with IQs at or above 90 and the 56 caregivers of children with IQs below 90 (P = .63). Characteristics of children at time of testing were similar (Table 3; all P ≥ .13) with no difference in percentages attending day care or Head Start (P = .20). Further, there was no association between placement in foster care and IQ group (P = .52).

With regard to caregivers, 125 have had urine screens on one or more occasions to test for the presence of cocaine metabolites (mean number of screens 2.3 ± 6.6 [mean ± SD]) for caregivers of children with IQs at or above 90 and 2.2 ± 0.9 for caregivers of children with IQs below 90). Similar proportions of both groups currently use cocaine (13% of caregivers for children with IQs at or above 90 and 24% of caregivers for children with IQs below 90 [P = .28]). To date, 46% (14/30) of biological parents of children with IQs at or above 90 and 51% (33/66) of biological parents of children with IQs below 90 have had the WAIS-R administered. As expected there is a moderate correlation between parental and child Full Scale IQ scores (r = 0.38, P = .002). Although scores of parents of children with IQs below 90 were lower than scores of parents of children with IQs at or above 90, this difference was not statistically significant (P = .21 [Table 3]). The educational level of the caregivers at the time of child testing was also similar.

The PCIS scores were obtained for 66% of the caregivers of children with IQs at or above 90 and 71% of the caregivers of children with IQs below 90 (Table 4).
Caregivers of children with IQs at or above 90 had a higher score than caregivers of children with IQs below 90 on the Summary Appropriateness Scale (P = .04), indicating more developmentally appropriate interactions by the caregiver with the child. Groups also differed in 6 of 8 HOME subscales and in the Total HOME score, with children with IQs at or above 90 having statistically higher scores than children with IQs below 90 (all P < .05 [Table 5]).

We performed a forced-entry multivariable logistic regression to ascertain which variables distinguished children with IQs at or above 90 and those with IQs below 90. The independent variables forced to enter were the Total HOME score, the PCIS Summary scores, sex, age of child, foster care placement, day care/Head Start attendance, caregiver educational level, current use of cocaine, and alcohol and maternal age, gravidity, parity, and prenatal care. Only the Total HOME score was statistically significant, eg, PCIS Summary scores (P > .15), maternal prenatal characteristics (P > .38), foster care or attendance at daycare or Head Start (P > .36), current cocaine use (P = .48).

### Table 1. Wechsler Preschool and Primary Scale of Intelligence–Revised*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>IQ &lt; 90 (n = 118)</th>
<th>IQ ≥ 90 (n = 32)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance IQ</td>
<td>102.1 ± 9.3</td>
<td>80.7 ± 10.7</td>
<td>.27</td>
</tr>
<tr>
<td>Verbal IQ</td>
<td>93.1 ± 5.4</td>
<td>76.5 ± 8.0</td>
<td>.001</td>
</tr>
<tr>
<td>Full Scale IQ</td>
<td>96.9 ± 5.9</td>
<td>76.2 ± 8.6</td>
<td>.001</td>
</tr>
</tbody>
</table>

*a Values are expressed as mean ± SD. P values were <.001 for all scales.

**COMMENT**

Poor performance on standardized intelligence tests is reported for children in poverty. Thus, it is not surprising that our cohort of inner-city children, all of whose mothers were receiving medical assistance at their child's birth, had mean Full Scale IQ scores below the test standard score of 100. However, the fact that 118 (79%) of the 150 children scored well below Average (76.2 ± 8.6 [mean ± SD]) is of concern, especially at a time when IQ scores are reported to be rising, the so-called Flynn effect. While IQ heritability may be as much as 60%, nongenetic influences, potentially malleable, account for the other 40%. Given the poor scores in more than three fourths of our cohort, we compared our 2 groups, looking for factors that differentiated achievers from the children scoring below Average. We hoped to define factors that could be manipulated to provide better cognitive outcome for children with low scores.

While Devlin et al recently reported the likely importance of the “maternal womb environment” in determining IQ, we found no difference between our 2 groups in numerous prenatal variables, including prenatal exposure to cocaine, with each group having approximately half of its subjects exposed in utero to this substance. Further, there was no difference in numerous natal variables, including admission to the newborn intensive care unit and findings on cranial ultrasonography.

The heritability of IQ is an accepted principle, although the magnitude is debated. While we do not yet have a full complement of parental IQ scores, the 67 available correlate with child IQ scores and demonstrate a numerical but not statistical difference between caregivers of children with IQs at or above 90 and those
with IQs below 90. This correlation is not unexpected because parental IQ has both a direct effect on child cognitive outcome and an indirect effect through parental influence on child environment. We are not so much interested, however, in heritable factors that influence IQ.

In our study we examined a number of postnatal influences. While there was no association between group Full Scale IQ score and caregiver (biological or foster mother), continued caregiver drug use, or child attendance at day care or Head Start, 2 postnatal factors were associated with differences in group Full Scale IQ: caregiver-child interaction and home environment. The PCIS results showed differences between groups in developmentally appropriate caregiver play, a measure that describes the degree to which the caregiver’s behavior is matched to the child’s developmental level. The PCIS Summary Quality score, which measures degree of emotional warmth, acceptance, sensitivity, and flexibility demonstrated during play behavior, was higher in caregivers of children with IQs at or above 90 but this difference did not reach statistical significance. In multiple reports, a child’s postnatal home environment has been found to be a strong correlate of cognitive outcome. The degree of security experienced in the home, the quality of interpersonal interactions, as well as the provision of cognitively stimulating materials are critical links to positive school achievement and adjustment and social and emotional well-being. In this regard, using logistic regression, the home environment was the single factor that differed between our children with Average or above-Average scores and our children with below-Average scores. For individuals not familiar with the HOME, several samples of subscale items in which the 2 groups differed follow. (1) Learning Stimulation: the child has toys that teach color, size, and shape; at least 10 books are visible in the apartment; the child is encouraged to learn shapes; (2) Language Stimulation: parent encourages the child to talk and takes time to listen; (3) Warmth and Acceptance: parent praises the child’s qualities twice during the visit; (4) Academic Stimulation: child is encouraged to learn spatial relationships (Legos, blocks, puzzles); (5) Modeling: child can express negative feelings without reprisal; (6) Variety in Experience: child has been on a trip within 50 miles during the last year; and (7) Acceptance: child’s artwork is displayed someplace in the house. Interestingly, there was no difference in the physical environment of the home between the 2 groups (P = .25).

Our data suggest that it is not the particular caregiver (biological or foster) or attendance at day care or Head Start that promotes better cognitive outcome. While these findings are inconsistent with data from some other investigations, our lack of detailed information regarding the quality of our children’s preschool experience precludes comparison with these studies. Improving the home environment and improving caregiver (foster or biological) interactive skills appear to be the most substantial changes that would effect improved IQ scores. From examples cited from the HOME, improving the child's home environment would not be costly in the sense of material acquisitions. Rather, interventions such as increasing emotional and social support for caregivers, increasing resources, and offering caregiver education opportunities should be targeted to improve the environment.

Recognition of the importance of the home environment and caregiver interaction to cognitive outcome is not a novel observation. We feel our data are important, however, because (1) we were able to evaluate numerous prenatal and natal factors and found no association with outcome and (2) the difference in the IQs between our groups is so great that defining any factor that would improve IQ in the below-Average group is critical for inner-city children. We are optimistic that improving caregiver interaction and the home environment would not be costly.
ment of these children will lead to better cognitive outcomes, and thus better school performance. The mechanisms for effecting such improvements, however cumbersome or daunting, should be a priority in our nation's cities.

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REFERENCES


