The Behavioral and Emotional Well-being of School-age Children With Different Birth Weights

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ABSTRACT. Objective. To describe the mental and emotional well-being of children born at different birth weights assessed at school age and to identify neonatal, intervening health, and sociodemographic and environmental factors associated with mental and emotional well-being.

Methods. To address this issue, we used a prospective cohort study involving two previously studied cohorts, which were recontacted at 8 to 10 years of age to provide a multisite sample of 247 children weighing 1000 g or less at birth, 364 weighing 1001 to 1500 g, 724 weighing 1501 to 2500 g, and 533 weighing more than 2500 g. Maternal reports were obtained on three standardized measures of mental and emotional well-being (the Rand General Well-being Scale, the Behavior Problem Index, and the Harter Scale of Child Competence) and on intervening health, sociodemographic, and environmental variables. Neonatal variables were derived from records at birth. Statistical techniques included analysis of variance and ordinary least squares multiple regression.

Results. Lower birth weight children did not differ on the General Well-being Scale but were more likely to have behavior problems and to be considered less competent. Other important correlates of mental and emotional well-being included childhood illness, maternal mental health, home environment score, and exposure to household cigarette smoking.

Conclusion. Although lower birth weight children have poorer mental and emotional well-being, a substantial portion of this adverse outcome reflects modifiable environmental factors. Pediatrics 1996;97:18–25; mental health, behavior problems, low birth weight, health status.

ABBREVIATIONS. VLBW, very low birth weight; GWBS, General Well-being Scale; BPI, Behavior Problem Index; GHQ, General Health Questionnaire.

The dramatic increase in survival of very low birth weight (VLBW, ≤1500 g) infants has generated substantial concern about their subsequent development and functioning. Much of the attention has focused on neurodevelopmental outcomes, more specifically, cognitive development as measured by standard developmental or intelligence instruments and neurologic disorders such as cerebral palsy.1–7 However, concerns about behavioral and emotional development in these children also exist. The increased risk of poorer behavioral or emotional well-being, seen in earlier observational studies,8,9 has been confirmed in more recent studies using quantitative, standardized scales of behavior problems10–17 and emotional health.10,18,19

Thus, although most (but not all) studies20–22 argue for an increased risk of behavioral and emotional difficulties, the literature to date has several shortcomings. Most studies use only single measures related to these outcomes and, even with these measures, often provide little detail about birth weight differences across subscales. Those studies that have examined differences in types of behavior problems generally report difficulties in the areas of increased activity and decreased attention;10,13,16,17,22 other problems are also noted, although findings are inconsistent with respect to VLBW.10,13 In addition, assessment is hampered by the lack of comparability of instrumentation across studies. Finally, the extent to which emotional and behavioral difficulties in VLBW children might be ameliorated depends not only on this more detailed description of the nature of the difficulties but also on better delineation of the factors influencing the risk of such problems. Factors associated with increased risk of child behavior problems include lower socioeconomic status, stress on the family, maternal depression, and other developmental disorders,23 and many of these factors disproportionately characterize lower birth weight children and their families.

We have reported previously on the birth weight differences in ratings on scales tapping affective and behavior problems in a large cohort of school-age children of various birth weights.17 To provide greater detail on the issues influencing emotional and behavioral well-being of these children in this report, we examine these measures, with the addition of a third measure on social competence, with a detailed analysis of subscales and potential covariates on all measures.
METHODS

Sample
The data for this report were obtained as part of a study of the health and developmental outcomes of VLBW; the overall results have been reported, and the relevant methods will be summarized for this report. The VLBW children came from 10 of the 13 original centers participating in the randomized controlled trial of indomethacin for the treatment of patent ductus arteriosus (National Heart, Lung, and Blood Institute grant H-223121). From this cohort were selected all children with birth weights of 1000 g or less (n = 395) and a random sample of children weighing 1001 to 1500 g (n = 656) who had been discharged from the intensive care unit alive and were not known to have died in the intervening period, irrespective of their participation in the trial. To obtain observations on children of similar age but of heavier birth weights, children originally assessed as infants as part of the evaluation of the Robert Wood Johnson Foundation National Perinatal Regionalization Demonstration Program were selected from three of the participating sites. From this cohort were selected a sample of 1172 children with birth weights of 2500 g or less and 685 children with birth weights of more than 2500 g. All children in the study were contacted between April 1986 and November 1988, when most of the children were between 8 and 10 years of age, using a prespecified approach to locating and recruiting families, which has been described elsewhere. Overall, follow-up information was obtained on 65.1% of the entire sample. Nonrespondents were more likely to come from families with mothers with lower educational attainment and lower incomes but with children with fewer health problems in the newborn period. The final sample consisted of 247 children with birth weights of 1000 g or less, 364 with birth weights of 1001 to 1500 g, 724 with birth weights of 1501 to 2500 g, and 533 with birth weights of more than 2500 g.

Data Collection
For the purposes of this report, most data were derived from a parent interview on intervening child health, health and educational services use, and home environment. All items were selected to be appropriate over the entire age range or capable of generating age-standardized measures. The exception was the information pertaining to infancy, which was abstracted from files of data collected at that time.

Behavioral and emotional well-being was conceptualized to consist of affective health (depression and anxiety), behavioral problems, and self-competence components, as reported by parents.

Affective Health
This area was assessed using the General Well-being Scale (GWBS) for 5- to 12-year-olds developed for the National Health Insurance Study, consisting of 12 five-point Likert items scored as the arithmetic sum of all items with higher scores indicative of positive health. The questions ask the mother to assess the child's apparent mood during the past month by inquiring about such things as tension, cheerfulness, or sadness. In the National Health Insurance Study, the scores in a random sample of a general population averaged 61.5 with an SD of 7.0; no clinically significant cutoff scores have been established. The scale also has three subscales: depression, anxiety, and positive well-being.

Behavioral Health
Behavior was ascertained with the Behavior Problem Index (BPI, which is a modification of the Achenbach Child Behavior Checklist and other instruments compiled by Zill for the National Study of Children and which consists of 28 items describing largely negative behaviors scored dichotomously. Items include questions on mood but also ascertain other behaviors such as disobedience, fighting, impulsiveness, and destruction of belongings. Items reported as almost always present were scored as 1; any other response was as 0. Measures derived from this scale include the arithmetic sum over all items, with higher scores indicative of more behavior problems and a score greater than 14 consistent with clinically significant behavior problems. Five subscales can be derived and are described as "peer problems," "aggressive," "hyperactive," "depressive," and "whine."
TABLE 1. Covariates and Their Definitions

<table>
<thead>
<tr>
<th>Perinatal/neonatal variables</th>
<th>Maternal age at birth</th>
<th>Maternal educational achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode of delivery</td>
<td></td>
<td>Cesarean section, other</td>
</tr>
<tr>
<td>Plurality</td>
<td>Singleton, multiple birth</td>
<td></td>
</tr>
<tr>
<td>Birth order</td>
<td>0 (no previous births), 1, 2+</td>
<td></td>
</tr>
<tr>
<td>Birth weight</td>
<td>lb, g, ±1000, 1001–1500, 1501–2500, &gt;2500</td>
<td></td>
</tr>
<tr>
<td>Length of neonatal stay</td>
<td>Total duration in d on neonatal stay before coming home coded as ≈75th percentile for birth weight, &gt;75th percentile</td>
<td></td>
</tr>
</tbody>
</table>

Intervening health

| Rehospitalization          | Hospital admission between the neonatal period and interview |
| Serious condition          | Report of a diagnosis of one or more of 17 prespecified conditions |

Child gender

| Male, female |

Sociodemographic and environmental variables

| Child gender | Male, female |
| Family income | White, nonwhite |
| Adults in home | Both biologic parents, single parent, other configuration |
| Smokers in household | Presence/absence of any adult who smokes while at home |
| Family move | Change of residence of family since birth of child |
| Child in other household | Child has lived in another family/household for more than three months, not counting vacations |
| Home environment | Score of responses to questions derived from the school-aged HOME Scale and Schafer's Parent-Teacher Scale |
| Maternal mental health | Responses to the GHQ |
| Maternal physical health | Rating of health on single question as excellent, very good, good, fair, or poor; coded as fair/poor, other |

scale correlated most highly with all subscales of the GWBS. Finally, the behavioral competence subscale of the Harter scale correlated highly with the hyperactive, aggressive, and peer problems, subscales of the BPI. Thus, not only were the overall scales correlated with each other, but the correlations among the subscales suggested consistency among similar constructs derived from different instruments.

Birth Weight Differences

As previously reported, differences in mean total scores by birth weight were not seen for the GWBS but were seen for the BPI (Table 2). Post hoc comparisons with the latter revealed that the major difference of an increase in behavior problems was between normal birth weight and all LBW children, because the differences in mean scores among the lower birth weight groups were not significant. When the different birth weight groups were compared on the Harter scale, highly significant differences were seen, with lower birth weight children being rated less competent.

The total mean scores are similar to published representative samples for the GWBS and BPI and slightly higher than expected scores for the Harter

TABLE 2. Social and Emotional Development of School-age Children by Birth Weight

<table>
<thead>
<tr>
<th>Scale</th>
<th>Birth Weight (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤1000 (247)</td>
</tr>
<tr>
<td>GWBS</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>59.1 ± 7.79</td>
</tr>
<tr>
<td>Depress</td>
<td>14.7 ± 2.74</td>
</tr>
<tr>
<td>Anxiety</td>
<td>24.4 ± 3.74</td>
</tr>
<tr>
<td>Wellness</td>
<td>20.0 ± 2.99</td>
</tr>
<tr>
<td>BPI</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>11.5 ± 6.46</td>
</tr>
<tr>
<td>Peer problems</td>
<td>2.68 ± 2.39</td>
</tr>
<tr>
<td>Aggressive</td>
<td>3.26 ± 2.11</td>
</tr>
<tr>
<td>Hyperactive</td>
<td>5.12 ± 2.75</td>
</tr>
<tr>
<td>Depressive</td>
<td>1.76 ± 1.54</td>
</tr>
<tr>
<td>Whine</td>
<td>1.76 ± 1.33</td>
</tr>
<tr>
<td>Harter scale perceived competence</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>106.3 ± 16.1</td>
</tr>
<tr>
<td>Athletic competence</td>
<td>15.3 ± 3.9</td>
</tr>
<tr>
<td>Behavioral competence</td>
<td>17.5 ± 4.1</td>
</tr>
<tr>
<td>Physical appearance</td>
<td>18.7 ± 4.2</td>
</tr>
<tr>
<td>Scholastic competence</td>
<td>15.7 ± 4.5</td>
</tr>
<tr>
<td>Social acceptance</td>
<td>17.0 ± 3.0</td>
</tr>
<tr>
<td>Global competence</td>
<td>19.0 ± 3.7</td>
</tr>
</tbody>
</table>

* Values are mean ± SD. Total in each birth weight group; ns for each instrument vary slightly because of missing data.
+ P < .0001.
scale, indicating higher rated competency. Thus, on average, even the extremely small infants (≤1000 g) were considered by their parents to be similar to general populations. For the one instrument for which a score indicating clinically significant derangement is available, the BPI, the proportions greater than the clinical cutoff of 14 were 29.2% for those weighing 1000 g or less, 27.6% for those weighing 1001 to 1500 g, 29.4% for those weighing 1501 to 2500 g, and 21.2% for those weighing more than 2500 g. Any LBW child was twice as likely as an normal birth weight child to have a clinically significant score.

Further examination of the subscale scores revealed that the lack of birth weight effect was consistent across all GWBS subscales. For the BPI, birth weight differences were concentrated in the hyperactive and whine subscales, and the lack of birth weight difference in the depressive subscale was consistent with the GWBS results. Birth weight differences were seen for all subscales of the Harter scale except physical appearance. The parental rating of lower competence in behavior and social acceptance is as consistent with a higher level of behavior problems, and lower ratings on athletic and scholastic competence are consistent with well-established neurodevelopmental sequela of prematurity.

Neonatal Factors

To assess what factors might be influencing parental assessments of the child’s behavioral and emotional well-being, we first examined the association of the three measures with factors present around the time of the child’s birth (Table 3). The mode of delivery and duration of neonatal hospitalization adjusted for birth weight were not associated with any of the three measures, and plurality and birth order were each only weakly associated with a single measure. The major factors were maternal age at birth and maternal educational attainment when the child was an infant. Younger mothers rated their children worse on all measures (ie, worse affective health, more behavior problems, and less competent), and mothers of lower educational attainment rated their children worse on behavior problems and competence.

An examination of subscale scores by maternal age revealed parallel significant differences in all subscales with the exception of the well-being subscale of the GWBS and the athletic competence and social acceptance subscales of the Harter scale. Less well-educated mothers were likely to rate their children worse on all subscales except the anxious subscale of the GWBS (despite an overall lack of association), and the athletic competence, physical appearance, and social acceptability subscales of the Harter scale.

Intervening Health Factors

Behavioral and emotional indices of health were rated worse among children with one or more of the specified health conditions (Table 3), and this association was seen for all subscales of all measures. In contrast, the experience of being rehospitalized between the newborn period and the time of the interview influenced neither total nor any subscale scores.

### TABLE 3. Social and Emotional Development of School-age Children by Perinatal and Neonatal Variables and Intervening Health*  

<table>
<thead>
<tr>
<th>Variable</th>
<th>GWBS</th>
<th>BPI</th>
<th>Harter Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age at birth (y)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤19 (334)</td>
<td>12.29 ± 6.63</td>
<td>109.8 ± 15.9</td>
<td></td>
</tr>
<tr>
<td>≥20 – 34 (144)</td>
<td>11.04 ± 6.55</td>
<td>110.9 ± 15.9</td>
<td></td>
</tr>
<tr>
<td>≥35 (110)</td>
<td>10.92 ± 6.50</td>
<td>111.0 ± 15.9</td>
<td></td>
</tr>
<tr>
<td>Maternal educational achievement when child was an infant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;HSG (457)</td>
<td>12.00 ± 6.55</td>
<td>110.8 ± 15.4</td>
<td></td>
</tr>
<tr>
<td>HSG (790)</td>
<td>12.06 ± 6.58</td>
<td>110.9 ± 16.3</td>
<td></td>
</tr>
<tr>
<td>&lt;HSG (641)</td>
<td>12.03 ± 6.30</td>
<td>111.0 ± 15.0</td>
<td></td>
</tr>
<tr>
<td>Mode of delivery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cesarean section</td>
<td>10.38 ± 6.52</td>
<td>110.9 ± 15.9</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>10.36 ± 6.60</td>
<td>112.1 ± 15.8</td>
<td></td>
</tr>
<tr>
<td>Plurality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Singleton (1617)</td>
<td>10.52 ± 6.50</td>
<td>112.0 ± 15.7</td>
<td></td>
</tr>
<tr>
<td>Plural (271)</td>
<td>9.55 ± 7.06</td>
<td>111.8 ± 16.5</td>
<td></td>
</tr>
<tr>
<td>Birth order</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 (731)</td>
<td>10.63 ± 6.69</td>
<td>111.6 ± 15.5</td>
<td></td>
</tr>
<tr>
<td>1 (522)</td>
<td>10.17 ± 6.61</td>
<td>112.7 ± 15.9</td>
<td></td>
</tr>
<tr>
<td>2 + (630)</td>
<td>10.27 ± 6.46</td>
<td>111.2 ± 16.2</td>
<td></td>
</tr>
<tr>
<td>Length of neonatal stay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤25th percentile</td>
<td>10.10 ± 6.52</td>
<td>112.0 ± 16.1</td>
<td></td>
</tr>
<tr>
<td>Maternal age at birth (y)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;75th percentile</td>
<td>10.49 ± 6.6</td>
<td>111.6 ± 15.8</td>
<td></td>
</tr>
<tr>
<td>Rehospitalization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (469)</td>
<td>10.35 ± 6.54</td>
<td>110.7 ± 15.8</td>
<td></td>
</tr>
<tr>
<td>No (1396)</td>
<td>10.48 ± 6.74</td>
<td>112.2 ± 15.9</td>
<td></td>
</tr>
<tr>
<td>Other serious conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (1049)</td>
<td>11.32 ± 6.68</td>
<td>109.6 ± 16.2</td>
<td></td>
</tr>
<tr>
<td>No (803)</td>
<td>9.08 ± 6.23</td>
<td>114.9 ± 14.8</td>
<td></td>
</tr>
</tbody>
</table>

* Values are mean ± SD. HSG, high school graduate.
† P < .0005.
‡ P < .0001.
§ P < .05.
TABLE 4. Social and Emotional Health of School-age Children and Sociodemographic and Environmental Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>GWB</th>
<th>BPI</th>
<th>Harter Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (948)</td>
<td>59.3 ± 8.0</td>
<td>10.78 ± 6.64</td>
<td>111.7 ± 15.9</td>
</tr>
<tr>
<td>Female (935)</td>
<td>59.6 ± 7.6</td>
<td>9.98 ± 6.17</td>
<td>111.91 ± 15.8</td>
</tr>
<tr>
<td>Child race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White (1130)</td>
<td>59.3 ± 7.6</td>
<td>9.97 ± 6.53</td>
<td>112.0 ± 15.4</td>
</tr>
<tr>
<td>Nonwhite (558)</td>
<td>59.7 ± 8.3</td>
<td>11.37 ± 6.62</td>
<td>111.4 ± 16.8</td>
</tr>
<tr>
<td>Family income</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower (633)</td>
<td>58.7 ± 8.68</td>
<td>11.33 ± 6.59</td>
<td>109.8 ± 16.8</td>
</tr>
<tr>
<td>Middle (627)</td>
<td>59.7 ± 7.3</td>
<td>9.53 ± 6.30</td>
<td>111.9 ± 14.9</td>
</tr>
<tr>
<td>Higher (509)</td>
<td>59.9 ± 7.1</td>
<td>8.99 ± 6.47</td>
<td>114.4 ± 15.6</td>
</tr>
<tr>
<td>Adults in home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Both biologic parents (1280)</td>
<td>59.7 ± 7.5</td>
<td>9.89 ± 6.50</td>
<td>112.5 ± 15.4</td>
</tr>
<tr>
<td>Single parent (507)</td>
<td>58.8 ± 8.2</td>
<td>11.50 ± 6.66</td>
<td>110.0 ± 16.8</td>
</tr>
<tr>
<td>Other (75)</td>
<td>59.3 ± 9.6</td>
<td>11.38 ± 6.57</td>
<td>111.0 ± 16.6</td>
</tr>
<tr>
<td>Smokers in household</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (998)</td>
<td>59.0 ± 8.56</td>
<td>11.34 ± 6.61</td>
<td>110.4 ± 15.7</td>
</tr>
<tr>
<td>No (881)</td>
<td>60.0 ± 6.9</td>
<td>9.31 ± 6.41</td>
<td>113.3 ± 15.8</td>
</tr>
<tr>
<td>Family has moved since birth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (1247)</td>
<td>59.1 ± 7.3</td>
<td>10.7 ± 6.64</td>
<td>111.5 ± 16.0</td>
</tr>
<tr>
<td>No (610)</td>
<td>60.2 ± 8.0</td>
<td>9.8 ± 6.44</td>
<td>112.5 ± 15.5</td>
</tr>
<tr>
<td>Child has lived in other household</td>
<td>58.7 ± 9.06</td>
<td>11.2 ± 6.5</td>
<td>109.0 ± 16.4</td>
</tr>
<tr>
<td>Yes (381)</td>
<td>59.6 ± 7.5</td>
<td>10.2 ± 6.6</td>
<td>112.5 ± 15.7</td>
</tr>
<tr>
<td>No (1463)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correlations with</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home environment score</td>
<td>.127‡</td>
<td>.108‡</td>
<td>.165‡</td>
</tr>
<tr>
<td>GHQ score</td>
<td>−.288‡</td>
<td>.295‡</td>
<td>−.209‡</td>
</tr>
</tbody>
</table>

* Values are mean ± SD.
† P < .01.
‡ P < .0005.
§ P < .05.
¶ P < .005.
§§ P = .0001.

Sociodemographic and Environmental Factors

Among the sociodemographic factors in Table 4, family income in the lower third for the sample, the presence of one or more smokers in the household, and the child having lived in another household for more than three months were associated with significantly worse behavioral and emotional health on all three measures. In addition, poorer status on all measures was correlated with higher General Health Questionnaire (GHQ) scores for the mother (ie, worse maternal mental health) and lower home environment scores (ie, less-stimulating or less-organized environment). One or more moves or changes of residence was associated with worse status on the GWB5 and BPI. Single-parent households worsened BPI and Harter scores, as revealed by posthoc testing of two-way comparisons. Finally, boys and nonwhite children were rated as having more problems on the BPI only.

When a sociodemographic or environmental factor was significantly associated with the overall score on one of the measures of behavioral and emotional well-being, the influence of that factor on subscales of the measure was examined further. Thus, for those factors associated with the GWB5, these differences were concentrated in the anxious and depressed subscales with no differences in the well-being scale noted. All factors associated with the BPI were significantly different on the hyperactive and peer problems subscales, and also on the aggressive subscales, with the exception of the child having lived in another household. More variation in association among these factors with the depressive and white subscales was seen. For the factors associated with the Harter scale, significant differences were less often seen for the athletic competence, physical appearance, and social acceptance subscales than for other subscales.

Multivariate Analyses

Ordinary least squares multiple regression was conducted to ascertain which variables retained a relationship with measures of behavioral and emotional health, and, in particular, whether birth weight continued to be associated with these measures after other covariates were entered. Variables entered into these equations were those found to be associated with any one of the measures in the preceding analysis.

As seen in Table 5, the variables most highly significantly associated with all measures of child well-being are the presence of one or more of the diagnosed conditions and the GHQ score, the measure of maternal mental health. The presence of one of the prespecified conditions retained its significance when diagnoses potentially related to the dependent variable were eliminated (eg, learning disorder or hyperactivity) in results not shown here. Both of these variables increased the risk of poorer behavioral and emotional health, ie, lowered GWB5 and Harter scores and increased BPI scores. In contrast, a maternal report of a more positive home environment significantly improved all measures.

Variables associated with two of the three measures included race, the presence of a smoker in the household, fair or poor maternal physical health, and moderate LBW (1501 to 2500 g). Mothers of nonwhite chil-
TABLE 5. Multivariate Analysis of the Social and Emotional Health of School-age Children

<table>
<thead>
<tr>
<th></th>
<th>GWB</th>
<th>BPI</th>
<th>Harter Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficients for Intercept</td>
<td>53.1</td>
<td>13.1</td>
<td>91.8</td>
</tr>
<tr>
<td>Maternal age ≤19 y</td>
<td>-1.093</td>
<td>0.737</td>
<td>0.016</td>
</tr>
<tr>
<td>Maternal age ≥35 y</td>
<td>1.341</td>
<td>0.331</td>
<td>1.240</td>
</tr>
<tr>
<td>Maternal education &lt;high school</td>
<td>0.759</td>
<td>0.362</td>
<td>-0.974</td>
</tr>
<tr>
<td>Total conditions</td>
<td>-1.772*</td>
<td>1.757*</td>
<td>-4.159*</td>
</tr>
<tr>
<td>Male child</td>
<td>0.210</td>
<td>0.351</td>
<td>0.728</td>
</tr>
<tr>
<td>Nonwhite</td>
<td>1.445†</td>
<td>0.071</td>
<td>2.115‡</td>
</tr>
<tr>
<td>Low income</td>
<td>0.253</td>
<td>0.773</td>
<td>0.048</td>
</tr>
<tr>
<td>Single parent</td>
<td>-0.131</td>
<td>0.127</td>
<td>-0.559</td>
</tr>
<tr>
<td>Smoker in household</td>
<td>-0.472</td>
<td>1.229§</td>
<td>-2.121</td>
</tr>
<tr>
<td>Family moved</td>
<td>-0.727</td>
<td>0.238</td>
<td>-0.108</td>
</tr>
<tr>
<td>Child/different family</td>
<td>-0.482</td>
<td>0.682</td>
<td>-2.254‡</td>
</tr>
<tr>
<td>GHQ score</td>
<td>-0.529*</td>
<td>0.393*</td>
<td>-0.692*</td>
</tr>
<tr>
<td>Maternal health: fair/poor</td>
<td>-1.894∥</td>
<td>1.110‡</td>
<td>-0.463</td>
</tr>
<tr>
<td>Home environment score</td>
<td>0.088*</td>
<td>-0.071∥</td>
<td>0.285*</td>
</tr>
<tr>
<td>Birth weight ≤1000 g</td>
<td>-0.558</td>
<td>1.022</td>
<td>-7.169*</td>
</tr>
<tr>
<td>Birth weight 1001–1500 g</td>
<td>0.086</td>
<td>0.536</td>
<td>-4.405*</td>
</tr>
<tr>
<td>Birth weight 1501–2500 g</td>
<td>-0.029</td>
<td>0.778§</td>
<td>-1.938§</td>
</tr>
<tr>
<td>F</td>
<td>12.27*</td>
<td>15.64*</td>
<td>12.15*</td>
</tr>
<tr>
<td>df</td>
<td>17 1469</td>
<td>17 1469</td>
<td>17 1469</td>
</tr>
</tbody>
</table>
R²                      | .13   | .15   | .12          |

* P < .0001.
† P < .001.
‡ P < .05.
§ P < .0005.
∥ P < .01.

DISCUSSION

LBW children have poorer behavioral and emotional health than their normal birth weight peers on two of the three measures in this study. However, much of this association seems to be mediated by factors associated with the risk of lower birth weight than by birth weight itself. The types of factors that influence social and emotional development independent of birth weight argue for a role for early childhood intervention programs to improve the outcomes of such high-risk children. We will discuss each of these points below.

In view of the rapidly emerging literature, the influence of lower birth weights on increasing the risk of behavior problems is expected, 1,2-18 and our results both overall and for the subscales are similar to other reports using the BPI in other populations 2,16 or other related measures. 22,39 Although to our knowledge, no previous studies of the Harter scale among children of different birth weights have been reported, a significant association with birth weight could be anticipated considering the subscales of this measure and the previously documented behavior problems and school difficulties experienced by these children, 13,15,16,19,40 as well as their poorer performance on social competence subscales of standard behavior problem checklists. 10 Of interest for further investigation is the lack of a birth weight effect on the physical appearance subscale in view of the fact that VLBW children may be substantially shorter and more slender than average. 14,41,42

What is unexpected is the failure to find an association between birth weight and affective symptoms as captured by the GWBS. Two potential explanations may account for this finding. The first is that the measure relies on maternal reporting and the ability to make observations, and mothers (and other adults) may have difficulty observing sadness and anxiety in children. Additionally, behavioral manifestations and emotional disturbance may be expressed somewhat differently in childhood and adolescence. 63-4 Finally, feeling states are not always accompanied by overt behavior, making sources other than self-reports problematic. For example, maternal reports and self-reports of depression among older children and adolescents are not highly correlated 45,46 Both of the latter mechanisms are supported in recent studies, 67 but in the absence of alternative sources of information, we are unable to ascertain which explanation is more relevant.

The finding that two of the factors influencing all three dimensions of behavioral and emotional outcome are child health problems and maternal mental health is consistent with previous literature on the increased risk of children with chronic health problems for behavioral and adjustment difficulties. 48,49 as well as the association of chronic child health problems with parental emotional distress. 8,50 The effect of the presence of one or more chronic health problems also may account for our failure to replicate an independent association of previous hospitalization with behavior problems, 51-53 because the association may be with the illness and resulting hospital episodes rather than the
hospitalizations themselves. The third factor associated with all three measures of social and emotional status is the maternal report of the home environment, specifically on active learning experiences, reading, and stimulating outings. These aspects of the home environment consistently have been associated with and predictive of cognitive development and school achievement and, to a lesser extent, behavior problems.24,25 Finally, for two of the three measures, passive exposure to household cigarette smoking increased the risk of adverse states, a finding that replicates another report,26,27 unfortunately, because of the limited data on smoking during pregnancy in our study, we cannot contribute new information to the differences between these reports on the independent effect of smoking after pregnancy and that of smoking during pregnancy.

When these factors are included in the multivariate analysis, more traditional measures of socio-economic status, such as maternal age or education at birth and family income, and even child gender, cease to be significant predictors of outcome. These findings reinforce the potential for interventions to improve child social and behavioral competence. Substantial improvements in child behavioral outcomes have been demonstrated with interventions for chronically ill28 and LBW children.29-41 In the latter case, the improvement in child outcomes is associated with improvements in the home environment maternal mental health (J. Brooks-Gunn, 1994, draft to be submitted) and mother-infant interaction.42 If verified by other research, our findings also would provide yet another reason to encourage smoking cessation among parents.43

The results of our studies must be interpreted with their limitations in mind. First, with the exception of the neonatal period, the data are derived from maternal reports at school age. Thus, the direction of causality for some of the factors associated with poorer behavioral and emotional health may be difficult to ascertain. Equally important, the extent to which maternal perceptions of behavior reflect observable child behavior remains a highly controversial issue. Maternal, teacher, and child self-reports are known to vary,45 but which mode of data collection is appropriate in any given situation remains to be established.

Second, the results may be influenced by losses to the cohort. The direction of any bias is difficult to assess, because disproportionate losses among disadvantaged children may be offset by retention among those sicker in the newborn period. Biases attributable to cohort attrition, however, are much less likely to influence the association among variables in those completing interviews and, thus, are unlikely to negate our results.

Finally, the interpretation of the clinical significance of the reported scores and birth weight differences is not possible for two of the three measures. Information from the BPI indicates that 30% of LBW children have behavioral difficulties sufficiently severe to warrant treatment, and that this risk is twice that for normal birth weight children. Similar inferences are currently not possible for the GWBS and Harter scale, although norms and clinical utility of the adult version of the GWBS measure have been established,47 and work on the child version is progressing.

Implications

Lower birth weight children are at increased risk of poorer behavioral and emotional well-being. However, a substantial portion (but not all) of this risk seems to reflect primarily the postnatal environment and less birth weight per se. Reduction of this risk may involve participation in early intervention programs where available and attention to maternal mental health and health habits. Our results add yet another reason to reinforce attention to maternal depression and household smoking.

ACKNOWLEDGMENTS

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