Association of Maternal and Paternal IQ With Offspring Conduct, Emotional, and Attention Problem Scores

Transgenerational Evidence From the 1958 British Birth Cohort Study

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Context: Individuals with lower IQ scores have an increased risk of psychological disorders, mental health problems, and suicide; similarly, children with low IQ scores are more likely to have behavioral, emotional, and anxiety disorders. However, little is known about the effect of parental IQ on the mental health outcomes of their children.

Objective: To determine whether maternal and paternal IQ scores are associated with offspring conduct, emotional, and attention scores.

Design: Cohort study.

Setting: General population.

Participants: Members of the 1958 National Child Development Study and their offspring were studied. Of 2984 parent-offspring pairs with nonadopted children 4 years or older, 2202 pairs had complete data regarding all variables of interest and were included in the analyses.

Main Outcome Measures: Offspring conduct, emotional, and attention scores based on the Behavioral Problems Index for children aged 4 to 6 years or the Rutter A scale for children and adolescents 7 years and older.

Results: Little evidence was observed of any association of parental IQ with conduct or emotional problems in children aged 4 to 6 years. However, among children and adolescents 7 years or older, strong evidence was observed from age- and sex-adjusted models to support a decrease in conduct, emotional, and attention problems in those whose parents had higher IQ scores. These associations were linear across the full IQ range. Individual adjustments for socioeconomic status and the child's own IQ had limited effect. However, adjustments for Home Observation for Measurement of the Environment scores and parental malaise attenuated associations with the mother's IQ but had little effect on associations with the father's IQ (scores were available for only 1 parent for each child or adolescent). Strong associations were no longer evident in models that simultaneously adjusted for all 4 potential mediating variables.

Conclusions: Children whose parents score poorly on IQ tests may have an increased risk of conduct, emotional, and attention problems. The home environment, parental malaise, and the child's own IQ may have a role in explaining these associations.
as cognitive readiness for parenting and social support, although it is notable that both of these factors were correlated with maternal IQ and their inclusion might, therefore, have led to overadjustment. Goodman et al12 targeted a sample of 411 twins and found that, after adjustment for socioeconomic status (SES) and the child’s own IQ, children whose parents had a higher mean IQ had more emotional symptoms. Finally, results from the National Longitudinal Survey of Youth,13 which included 2256 children aged 4 to 11 years, did not show any effect of maternal IQ on offspring behavioral scores in multivariable models that also included a number of factors, such as family income (self-reported), maternal smoking status, and maternal educational level. However, children whose parents provided less cognitive stimulation and emotional support, as measured by poorer scores on the Home Observation for Measurement of the Environment (HOME) Inventory, had more behavioral problems.

In this report from the 1958 National Child Development Study, we examine associations of parental IQ with offspring conduct, emotional, and attention problem scores. Our analyses are based on data drawn from a large, British, representative cohort of parent-offspring pairs with IQ measurements in childhood available for offspring and parents and with participants from across the full IQ range. A major advantage of this study is the availability of both maternal and paternal IQ test scores, which allows a comparison of the strength of association of each with offspring development and behaviors. Similar magnitudes of effect for maternal and paternal IQ would suggest that associations are generated by factors that are as likely to be transmitted from father to offspring as they are from mother to offspring; these might include, for example, nuclear genetic variation, SES, or shared lifestyle factors. In contrast, a stronger maternal IQ association might suggest that maternal or intrauterine characteristics are more important in determining children’s development and behavior. Also, data are available regarding a number of potential mediating factors, which allows exploration of the possible mechanisms underlying any associations between parental IQ and offspring conduct, emotional, and attention problem scores. These mediating variables include SES, the child’s own IQ score, the quality and quantity of cognitive stimulation and emotional support as measured by HOME scores, and parental malaise.

**METHODS**

**STUDY POPULATION**

The National Child Development Study (1958 cohort) comprises more than 17,000 live births in Great Britain occurring between March 3 and March 9, 1958.14 Follow-up sweeps were performed in 1965, 1969, 1974, 1991, and 1999 to 2000. The 1991 follow-up collected data regarding the original cohort, then aged 33 years, and also from the offspring of 1 in 3 randomly selected cohort members. In the present analysis, parental data were obtained from the original study members of the 1958 cohort and offspring data from their children.

**PARENTAL DATA COLLECTION**

The cohort members’ mental abilities were assessed at school in 1969, at age 11 years, using a general-ability test devised by the National Foundation for Educational Research in England and Wales.15 Scores from this test correlate strongly with verbal-ability test scores used to select 11-year-olds for secondary school,15 which suggests a high degree of validity. Data regarding marital status and SES were collected 22 years later, in 1991; SES was based on one’s own occupation for male cohort members and one’s husband’s occupation for female cohort members. Psychological distress and depression in 1991 were measured using the Malaise Inventory.16

**OFFSPRING DATA COLLECTION**

Offspring cognitive ability–related tests, performed in 1991, were administered by interviewers and included the Peabody Picture Vocabulary Test–Revised (PPVT-R) (Form L), the McCarthy Scale of Children’s Abilities (verbal subscale), and the Wechsler Intelligencce Scale for Children (digit span subscale). The PPVT scores were measured in all children 4 years or older; we present results based on these data. However, results based on other IQ measures, which were available for a smaller subgroup of children, are broadly similar (results not shown; available on request from the authors). The PPVT is a widely used and recognized indicator of children’s cognitive function and has been shown to correlate well with IQ-type measures.17

The quality and quantity of cognitive stimulation and emotional support provided to children in the home were assessed using HOME scores,18 based on responses from mothers, regardless of the sex of the original cohort member. Similarly, conduct, emotional, and attention difficulties were assessed using mothers’ responses to the Behavior Problems Index19 for children aged 4 to 6 years or the Rutter A scale16 for children 7 years and older. These scales have been widely used and validated.10,20 The Behavior Problems Index consists of 32 items with 3 response options (often true, sometimes true, or not true). We subjected the mothers’ responses to these 32 items to principal components analysis. The scree slope suggested the presence of 2 factors after oblique rotation (direct oblimin), which accounted for 23.2% of the total variance. High loading items (>0.50) were retained, and the 2 extracted factors were labeled conduct problems and emotional problems. The Cronbach α values for these scales were 0.84 and 0.75, respectively. The Rutter A scale consisted of 18 items with 3 response options (certainly applies, applies somewhat, or does not apply). The scree slope from a principal components analysis of these items suggested the presence of 3 factors after oblique rotation (direct oblimin), which accounted for 24.3% of the total variance. High loading items (>0.50) were retained, and the 3 extracted factors were labeled conduct problems, emotional problems, and attention problems. The Cronbach α values for these were 0.78, 0.60, and 0.80, respectively.

**STATISTICAL ANALYSIS**

Parental IQ associations with offspring behavioral scores were based on cohort member–offspring pairs in which the offspring was nonadopted and aged 4 to 18 years at the time of data collection. Analyses were performed using least squares regression, and associations are presented as mean change in outcome per standard deviation increase in parental IQ score, having first checked that the associations were approximately linear. We performed separate analyses based on maternal vs paternal IQ to allow for differential effects and performed corresponding statistical tests for interaction or effect modificati-
The original sample consisted of 4287 parent-offspring pairs (Figure), and the offspring of 2984 (69.6%) were known to be nonadopted and 4 years or older in 1991 (when offspring IQ measurements were made). Parental IQ was unavailable for 379 (12.7%) of these pairs, and data regarding confounding variables were missing for a further 403 (13.5%), leaving an analytical sample of 2202 pairs. The characteristics of parents and offspring excluded from the analyses as a result of missing data were similar, although parental IQ, when available, was somewhat lower (mean [SD] parental IQ in those with missing vs complete confounding data, 38.4 [15.5] vs 42.8 [15.4]). For each child or adolescent, IQ scores were available for only 1 parent. Parental IQ and SES were higher in parent-offspring pairs who were excluded because the child was younger than 4 years in 1991, which would be consistent with higher-IQ cohort members choosing to have their children at later ages.

The analytical sample included a total of 1399 mother-offspring pairs (63.5%) and 803 father-offspring pairs (36.5%); their characteristics are given in Table 1. Just less than half of offspring were male, and this proportion, along with average offspring IQ, was similar in mother- vs father-offspring pairs. Almost two-thirds of cohort members were from SES III (the baseline category; skilled [nonmanual/manual] occupation), although fathers were slightly more likely to be from SES I (professional occupation) or II (managerial and technical/intermediate occupation), despite a slightly lower mean IQ at age 11. The main differ-
nce between mother- and father-offspring pairs was the
mean offspring age in 1991, which was 1.3 years lower in
father-offspring pairs, suggesting that men tended to be
slightly older than women when their children were born.

Correlations between parental IQ and malaise scores,
HOME score, and offspring IQ are given in Table 2. Off-
spring IQ and HOME scores were positively correlated
with maternal and paternal IQ. Malaise scores were nega-
tively correlated with parental IQ, most markedly in moth-
ers, indicating that parents with higher IQ were less likely
to be depressed. Pairwise correlations between HOME,
offspring IQ, HOME scores, and malaise scores were mod-
est in magnitude but statistically significant (P < .001 for
all correlations), with coefficients ranging from −0.10 (off-
spring IQ–parental malaise) to 0.22 (offspring IQ–
HOME score).

Associations of parental IQ with behavioral problem
scores are presented in Table 3 (mothers) and Table 4
(fathers). Approximately one-third of children were aged
4 to 6 years at data collection. Among this group, no
marked associations were observed between conduct
problem scores and maternal or paternal IQ. In adjusted
models, it was suggested that children with fathers with
higher IQ and, to a lesser extent, mothers with higher
IQ might have slightly higher scores for emotional prob-
lems, but this association was only of borderline statis-
tical significance.

Age- and sex-adjusted maternal IQ associations for
offspring 7 years and older (Table 3) indicated that chil-
dren whose mothers had higher IQ scores at 11 years of
age tended to have lower scores for conduct problems,
emotional problems, and attention problems. These as-
soociations were only affected marginally by adjustments
for SES and the child's own IQ. Individual adjustments
for HOME score and, in particular, the mother's malaise
score led to a more marked attenuation of associations;
however, 95% confidence intervals for those with con-
duct and attention problems remained below 0. Asso-
ciations adjusted for all 4 factors simultaneously no
longer were statistically significant at conventional lev-
els. Paternal IQ associations (Table 4) were based on
smaller numbers of parent–offspring pairs but were
similar to those for maternal IQ, with the children of
fathers with higher IQ scores having lower conduct, emo-
tional, and attention scores, although associations with
emotional scores were not conventionally statistically
significant. Again, these associations were largely unaf-
fected by individual adjustment for SES and offspring
IQ. However, in contrast to maternal IQ associations,
individual adjustment for HOME scores and paternal
malaise also had little or no effect on these results.
Again, multiply adjusted models were not convention-
ally statistically significant.

The marked attenuation of associations in multiply ad-
justed models is consistent with a mediating role of at
least 1 of SES, offspring IQ, HOME score, or parental
malaise. However, results from individually adjusted mod-
els suggest that these mediating effects were modest, and
no evidence was shown that any single factor explained
the associations between parental IQ and offspring con-
duct, emotional, and attention scores.

### Table 2. Correlations of Parental IQ Score With Parental Malaise, HOME, and Offspring IQ Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>Maternal</th>
<th>Paternal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offspring IQ score</td>
<td>0.30</td>
<td>0.31</td>
</tr>
<tr>
<td>HOME score</td>
<td>0.28</td>
<td>0.24</td>
</tr>
<tr>
<td>Parental malaise score</td>
<td>−0.24</td>
<td>−0.17</td>
</tr>
</tbody>
</table>


*P < .001 for all comparisons.

We have explored associations between parental IQ and
offspring conduct, emotional, and attention problems. No
evidence was shown to suggest that parental IQ had an
effect on the conduct problems of children aged 4 to 6
years. Also, an unexpected increase in emotional prob-
lems in younger children whose fathers, in particular, had
a higher IQ score was weakly suggested. Conversely,
among children 7 years or older, age- and sex-adjusted
analyses indicated that those with parents with higher
IQ scores had fewer conduct, emotional, and attention
problems. These associations were attenuated to some
extent by individual adjustments for SES, the child's own
IQ score, and, in the case of mothers particularly, HOME
scores and level of malaise; simultaneous adjustment for
all 4 factors markedly attenuated associations.

The current analyses have a number of advantages com-
pared with previous studies. In addition to the rela-
tively large sample size, the original cohort from which
our sample was drawn is representative of all men and
women born in Great Britain at around this time and, most
important, includes those with IQ scores from across the
full IQ range. Parental IQ was measured in childhood,
before any substantial effect of education on IQ test per-
formance. We also had data on potential mediating fac-
tors, such as SES, offspring IQ, HOME scores, and pa-
rental malaise, which has allowed a more detailed
exploration of the possible mechanisms underlying pa-
ternal IQ–offspring behavior associations. The Behavior
Problem Index and Rutter A tests used to measure chil-
dren's conduct, emotional, and attention problems are
well validated and widely used. Also, to our knowledge,
this analysis is unique in using IQ data from both moth-
ers and fathers.

However, our study has some limitations. Although all
cohort members were included in the main study follow-
up, only a third of cohort members with offspring were in-
vited to take part in the portions of the survey that in-
cluded the offspring. Cohort members excluded from our
analyses tended to have somewhat higher SES, although
it is reassuring that their mean IQ was almost identical to those
included in the analyses. Also, although we adjusted for
age and sex and also looked at the additional effect of ad-
justments for potential mediating factors, such as SES, off-
spring IQ, HOME scores, and parental malaise, we cannot
rule out residual confounding by other unmeasured con-
 founding or mediating factors. Conversely, it is important
to recognize that the 4 mediating factors were all corre-
related with parental IQ and with each other and that models that contain all 4 simultaneously (multiply adjusted models presented in Tables 3 and 4) may, therefore, be overadjusted. Also, although it is informative to consider the degree of attenuation due to statistical adjustment for these factors, we cannot draw any conclusions regarding direct causality. Finally, the possibility of biases cannot be ruled out. Children with behavioral problems may have performed particularly poorly in IQ tests, which could potentially inflate the confounding effects of offspring IQ. In addition, all of our outcome measures were based on maternal responses rather than direct observation of the children and may, therefore, be subject to reporting biases if mothers with higher or lower IQ scores were more likely to perceive or report problems with their children’s behavior. Nonetheless, consistent with a decrease in problems in younger children of parents with higher IQ scores, therefore, this result may simply be a chance finding as a result of multiple comparisons.

In contrast, age- and sex-adjusted associations in older (≥7 years) offspring were consistent with decreasing problems in children whose parents had higher IQ scores. Although some literature exists regarding the delayed development and worse behavior of children born to mothers with specific intellectual disabilities or below-average IQ scores, little is known about the effect on child behavior problems of parental IQ across the full IQ range. The associations among older children in the current analyses were linear across all parental IQ scores, suggesting that it is not parents’ intellectual disability that is associated with behavioral difficulties but rather that a gradient of effect can be observed across the full IQ range. To explore the possible mechanisms underlying these associations, we examined the effect of adjusting for a number of potential mediators, namely, SES, the child’s own IQ score, HOME scores, and parental malaise. The strong associations observed in age- and sex-adjusted models no longer were apparent in multiply adjusted models, suggesting that at least

Table 3. Association of the Mother’s IQ at 11 Years of Age With Offspring Conduct, Emotional, and Attention Problem Scores at 4 Years or Older

<table>
<thead>
<tr>
<th>Variable</th>
<th>No.</th>
<th>Mean (SD)</th>
<th>Offspring Age and Sex</th>
<th>Offspring Age, Sex, and SES</th>
<th>Offspring Age, Sex, and IQ</th>
<th>Offspring Age, Sex, and HOME Score</th>
<th>Offspring Age and Sex and Parental Malaise</th>
<th>Multiple b</th>
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</thead>
<tbody>
<tr>
<td>Conduct problems score</td>
<td></td>
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</tr>
<tr>
<td>SD increase d</td>
<td>420</td>
<td>22.8 (5.1)</td>
<td>−0.33 (−0.91 to 0.25)</td>
<td>−0.33 (−0.93 to 0.28)</td>
<td>−0.20 (−0.79 to 0.40)</td>
<td>0.04 (−0.55 to 0.63)</td>
<td>0.14 (−0.66 to 0.37)</td>
<td>0.17 (.55)</td>
</tr>
<tr>
<td>P value</td>
<td></td>
<td></td>
<td>.26</td>
<td>.29</td>
<td>.52</td>
<td>.89</td>
<td>.58</td>
<td>.55</td>
</tr>
<tr>
<td>Emotional problems score</td>
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<tr>
<td>SD increase d</td>
<td>422</td>
<td>15.9 (3.3)</td>
<td>0.05 (−0.31 to 0.41)</td>
<td>0.08 (−0.30 to 0.45)</td>
<td>0.04 (−0.32 to 0.40)</td>
<td>0.21 (−0.15 to 0.57)</td>
<td>0.13 (−0.21 to 0.47)</td>
<td>0.23 (.59)</td>
</tr>
<tr>
<td>P value</td>
<td></td>
<td></td>
<td>.79</td>
<td>.69</td>
<td>.83</td>
<td>.25</td>
<td>.46</td>
<td>.22</td>
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<tr>
<td>Conduct problems score</td>
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<tr>
<td>SD increase d</td>
<td>833</td>
<td>9.4 (2.3)</td>
<td>−0.49 (−0.73 to −0.25)</td>
<td>−0.53 (−0.78 to −0.28)</td>
<td>−0.44 (−0.69 to −0.19)</td>
<td>−0.33 (−0.57 to −0.09)</td>
<td>−0.31 (−0.54 to −0.09)</td>
<td>−0.22 (.02)</td>
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<tr>
<td>P value</td>
<td></td>
<td></td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.001</td>
<td>&lt;.01</td>
<td>&lt;.01</td>
<td>.07</td>
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<tr>
<td>Emotional problems score</td>
<td></td>
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<tr>
<td>SD increase d</td>
<td>831</td>
<td>7.5 (1.9)</td>
<td>−0.16 (−0.31 to −0.02)</td>
<td>−0.19 (−0.34 to −0.03)</td>
<td>−0.17 (−0.32 to −0.02)</td>
<td>−0.11 (−0.27 to 0.04)</td>
<td>−0.03 (−0.17 to 0.11)</td>
<td>−0.05 (.11)</td>
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<tr>
<td>P value</td>
<td></td>
<td></td>
<td>.03</td>
<td>.02</td>
<td>.03</td>
<td>.15</td>
<td>.86</td>
<td>.56</td>
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<tr>
<td>Attention problems score</td>
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<tr>
<td>SD increase d</td>
<td>835</td>
<td>4.3 (1.6)</td>
<td>−0.25 (−0.36 to −0.13)</td>
<td>−0.24 (−0.36 to −0.11)</td>
<td>−0.22 (−0.34 to −0.09)</td>
<td>−0.18 (−0.30 to −0.05)</td>
<td>−0.14 (−0.26 to −0.02)</td>
<td>−0.08 (.06)</td>
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<tr>
<td>P value</td>
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<td>.001</td>
<td>.001</td>
<td>.001</td>
<td>.01</td>
<td>.02</td>
<td>.27</td>
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</table>

Abbreviations: HOME, Home Observation for Measurement of the Environment; SES, socioeconomic status.

a For each child or adolescent, IQ scores were only available for 1 parent.
b Adjusted for offspring age, sex, and IQ; HOME score; SES; and parental malaise.
c Based on the Behavior Problems Index score.
d Mean change per SD increase.
e For linear trend.
f Based on the Rutter A score.
some of these factors had a mediating effect. However, results from analyses that adjusted for each factor individually showed only a modest degree of attenuation, if any, such that, although they each appeared to play some part, no single factor completely explained parental IQ–childhood behavior associations.

It is not surprising that adjustment for the child’s own IQ attenuated some of these associations but, notably, the degree of attenuation was relatively small and, in some cases, nonexistent. This indicates that parental IQ may have an independent effect on these outcomes beyond that conferred by inherited intellectual ability. Similarly, adjustment for SES had little effect on our results, suggesting that the potential material aspects of low parental IQ, such as unemployment, low household income, or living in an economically deprived area, did not play a substantial role in explaining these associations.

Previous studies suggest that parents with lower IQ scores may provide a less stimulating or supportive home environment and style may have a mediating role in explaining parental IQ–offspring behavior associations (ie, parents with lower IQ scores may provide less cognitive stimulation and emotional support, which may result in an increase in behavioral problems).

Similarly, lower IQ is known to be associated with an increased risk of depression in this and other populations. Adjustment for paternal malaise left associations of the father’s IQ with offspring behavior almost unchanged. Conversely, adjustment for maternal malaise had the greatest effect of any variable on associations with the mother’s IQ. Evidence exists that parental psychiatric disorders are associated with behavioral problems in children, and emotional support, which may result in an increase in behavioral problems.

Table 4. Association of the Father’s IQ at 11 Years of Age With Offspring Conduct, Emotional, and Attention Problem Scores at 4 Years or Older

<table>
<thead>
<tr>
<th>Variable</th>
<th>Offspring Age and Sex</th>
<th>Offspring Age, Sex, and SES</th>
<th>Offspring Age, Sex, and HOME Score</th>
<th>Offspring Age and Sex and Parental Malaise</th>
<th>Multiple</th>
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<tbody>
<tr>
<td>Conduct problems score</td>
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<tr>
<td>SD increase</td>
<td>313</td>
<td>22.9 (5.2)</td>
<td>−0.36 (−1.05 to 0.32)</td>
<td>−0.30 (−1.00 to 0.40)</td>
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<td></td>
<td>−0.29 (−0.98 to 0.40)</td>
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<td></td>
<td>−0.03 (−0.88 to 0.62)</td>
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<td></td>
<td>−0.22 (−0.91 to 0.48)</td>
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<td></td>
<td>−0.05 (−0.62 to 0.72)</td>
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<tr>
<td>P value</td>
<td>0.29</td>
<td>0.40</td>
<td>0.01</td>
<td>0.92</td>
<td>.54</td>
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<td></td>
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<td>.88</td>
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<tr>
<td>Emotional problems score</td>
<td>320</td>
<td>15.5 (2.7)</td>
<td>−0.33 (−0.07 to 0.73)</td>
<td>0.42 (−0.01 to 0.84)</td>
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<td></td>
<td>0.30 (−0.09 to 0.69)</td>
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<td>0.42 (0.01 to 0.83)</td>
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<td>0.38 (−0.02 to 0.79)</td>
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<td></td>
<td>0.47 (0.05 to 0.88)</td>
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<tr>
<td>P value</td>
<td>.11</td>
<td>.13</td>
<td>.04</td>
<td>.07</td>
<td>.03</td>
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</table>

Abbreviations: HOME, Home Observation for Measurement of the Environment; a For each child or adolescent, IQ scores were only available for 1 parent. SES, socioeconomic status. b Adjusted for offspring age, sex, and IQ; HOME score; SES; and parental malaise. c Based on the Behavior Problems Index score. d Mean change per SD increase. e For linear trend. f Based on the Rutter A score.
the relative effect of adjustments for mediating factors in mothers and fathers. Although the effects of adjustment for SES and offspring IQ were similar for both groups of parents, the effect of adjustment for HOME scores and, in particular, malaise was much greater in maternal IQ associations with offspring behavior. It is possible that this greater effect is simply a result of mothers providing offspring behavioral data. However, it also may reflect the more influential parenting role among mothers, who are more commonly the primary caregiver.

The etiology of child behavioral problems is complex, with many interrelated factors playing an important role. Our results suggest that the children of parents with lower IQ scores may be at high risk of conduct, emotional, and attention problems and that this may be a result, at least partially, of lower IQ in the child, a poorer home environment, and greater malaise in the parents. Further studies are needed to explore these mechanisms in more detail and to determine whether families of this type might benefit from additional or targeted education and support.

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